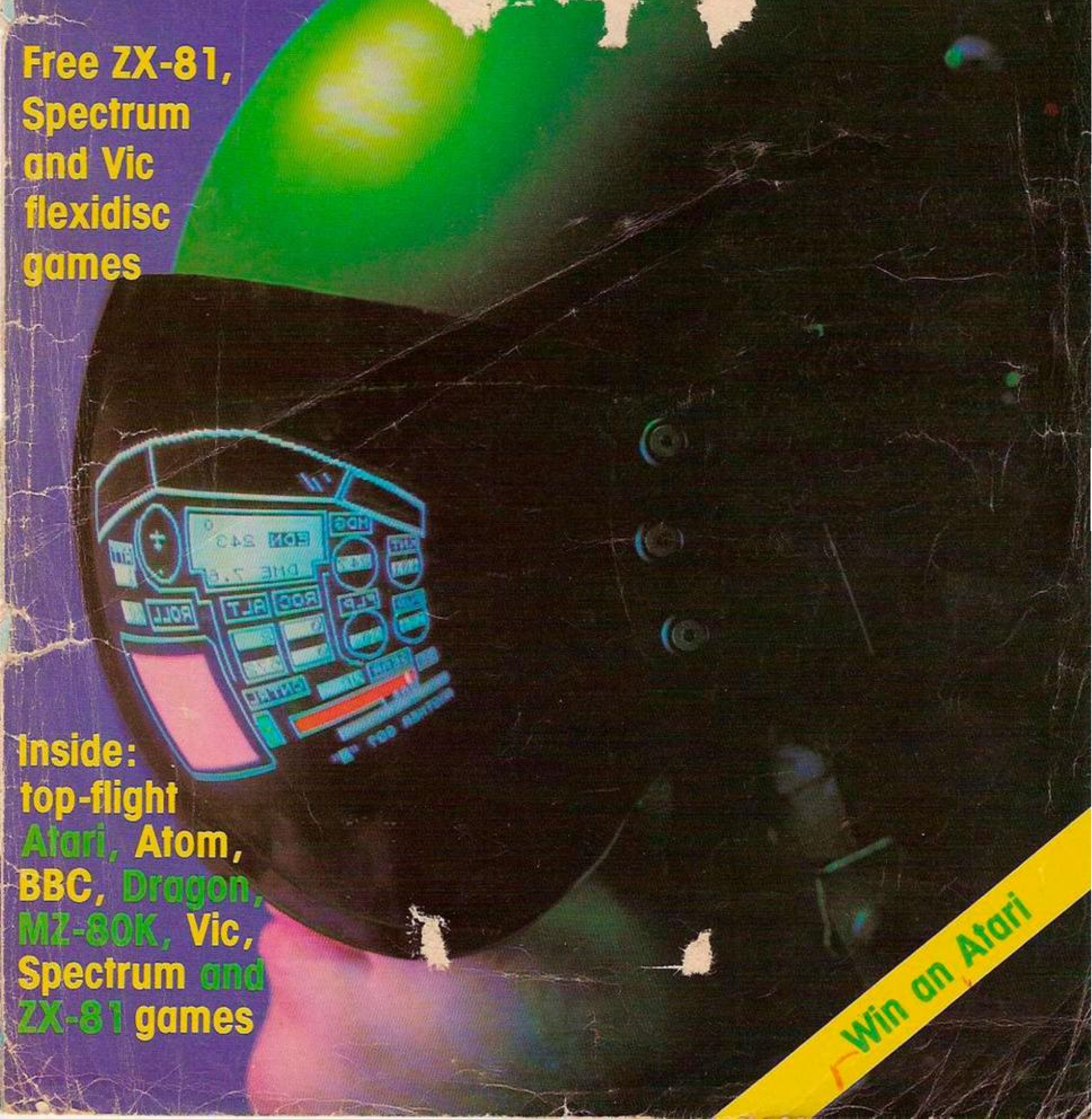
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YOUR COMPUTER

DECEMBER 1982 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol.2 No.12



Free ZX-81, Spectrum and Vic flexidisc games

Inside: top-flight Atari, Atom, BBC, Dragon, MZ-80K, Vic, Spectrum and ZX-81 games

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YOUR COMPUTER

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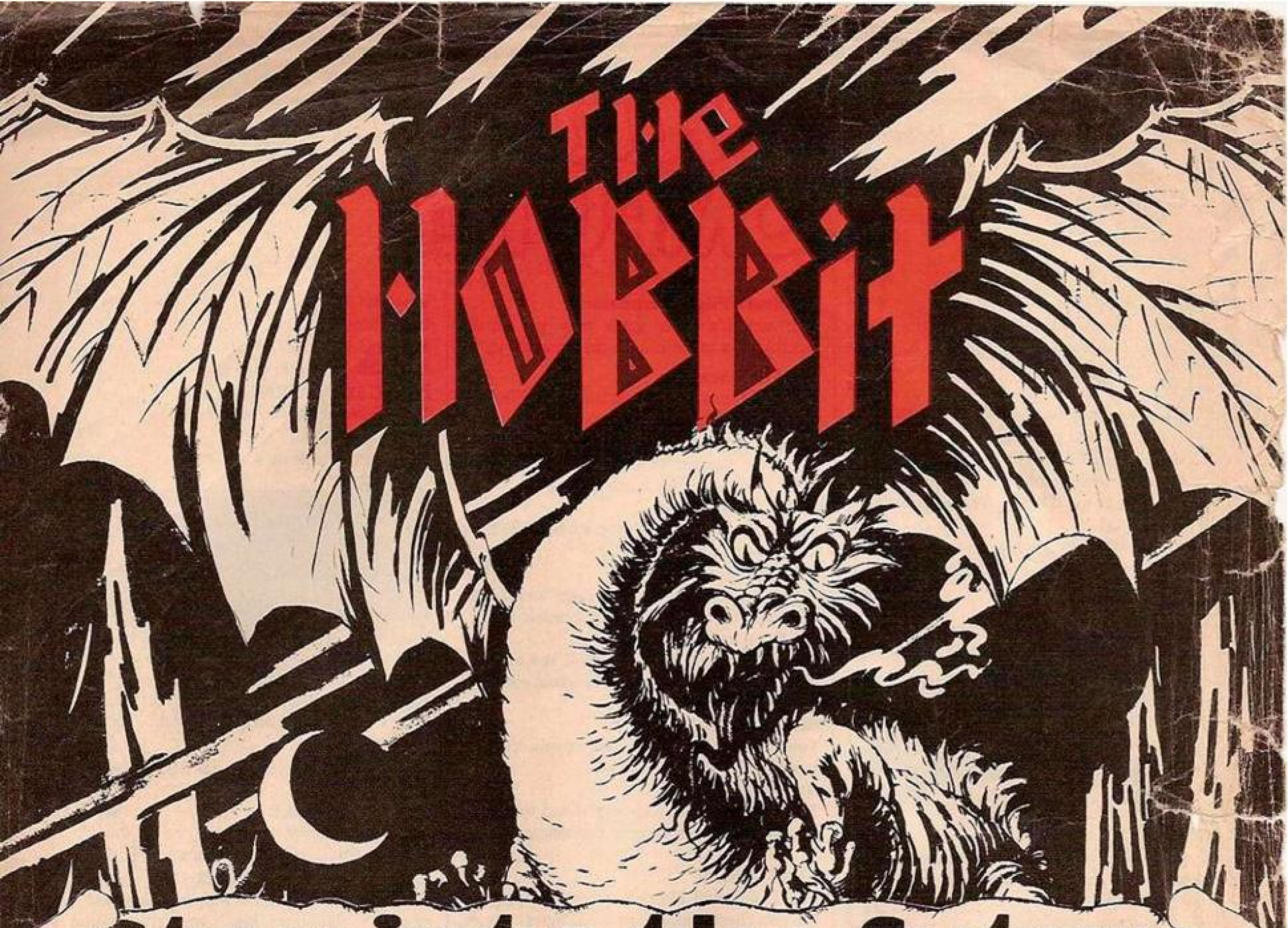
EDITORIAL

THE FAIRY LIGHTS are going out all over Europe this Christmas as computing's over-zealous yuletide recruits find that such seasonal fripperies as Christmas trees take up too much valuable socket space. This year home computers will shatter the traditional Noel idyll. Families will no longer cluster around roaring hearths opening presents and arguing about which of the four channels to watch — from now on it will be channel 36 or thereabouts. For the first time, this Christmas, people have a real choice of machines for less than £200 and an even wider selection if they can afford to go as high as £350.

But those who have decided to treat themselves or a member of their family to a micro will know that choosing a computer involves a selection process which makes the rest of the Christmas shopping almost look like fun. Few of those who emerge from this ordeal clutching a gift-wrapped micro will have given any real thought to what they want it for — most will be only too pleased to have found one at all in time for Christmas. The first discovery the would-be buyer makes is that only half of the dozen or so most attractive machines advertised are readily available. Having swallowed this unpalatable fact the next question must be: "Do I really need a micro for Christmas? Would a machine like the Lynx or the Oric — both unlikely to be seen in volume this side of the Feast of Stephen — better suit my needs and my budget?"

Waiting a few months for a machine which has already been launched can be a wise decision — but only if you are sure that it really fits your bill. What you should never do is put off buying a micro because you are convinced a wonder-machine is just round the corner. At the rate that microcomputer technology is accelerating, you will just defer your entry into computing indefinitely. Talk to someone who already has a machine and decide which features you most want to have on your micro. When you have shortlisted some candidates with the power, flexibility and software you require and which are available when you want them, your next major consideration must be price. Minimum outlay can mean minimal computing but on the other hand there is no point spending hundreds if you are not sure how long your interest in micros will last.

The final word must, regrettably, be a word of warning. If you want a micro by Christmas Day, make sure that the machine can be supplied on time and get it in writing. After all, children believe in Santa Claus; adults believe in delivery dates. ■



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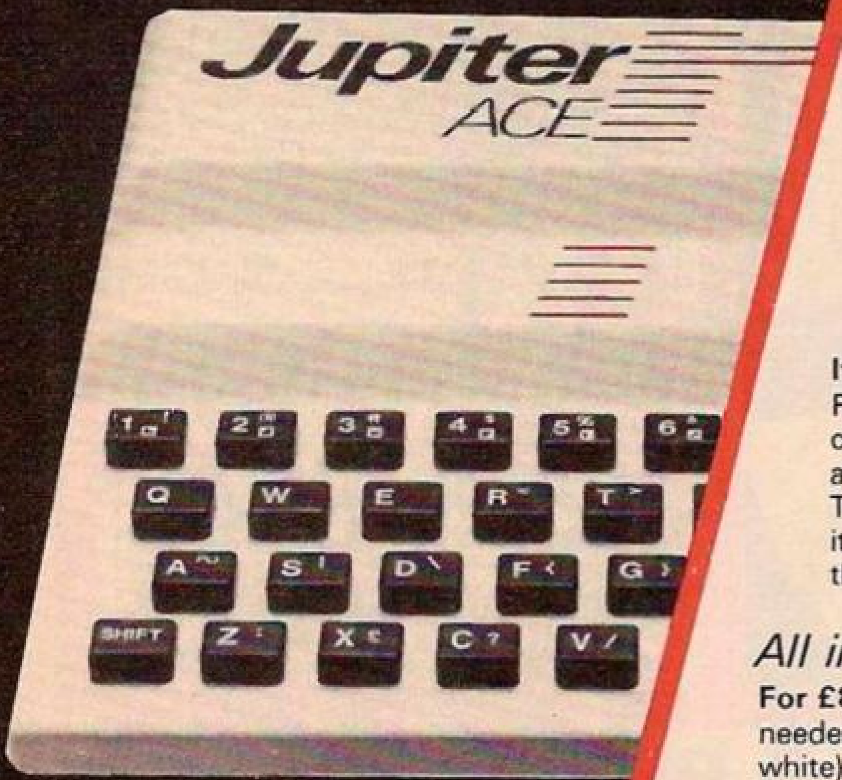
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YC1282 — Your Computer — December 1982

Jupiter ACE

The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

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Multiply two numbers	0.9	1.6	6.5	7.5	32

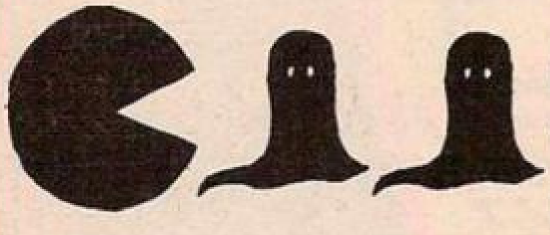
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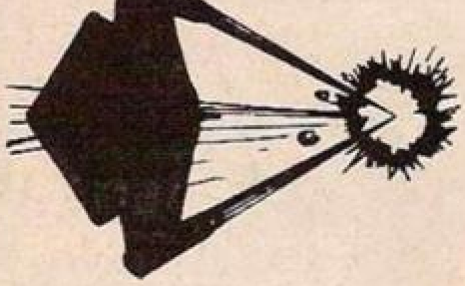
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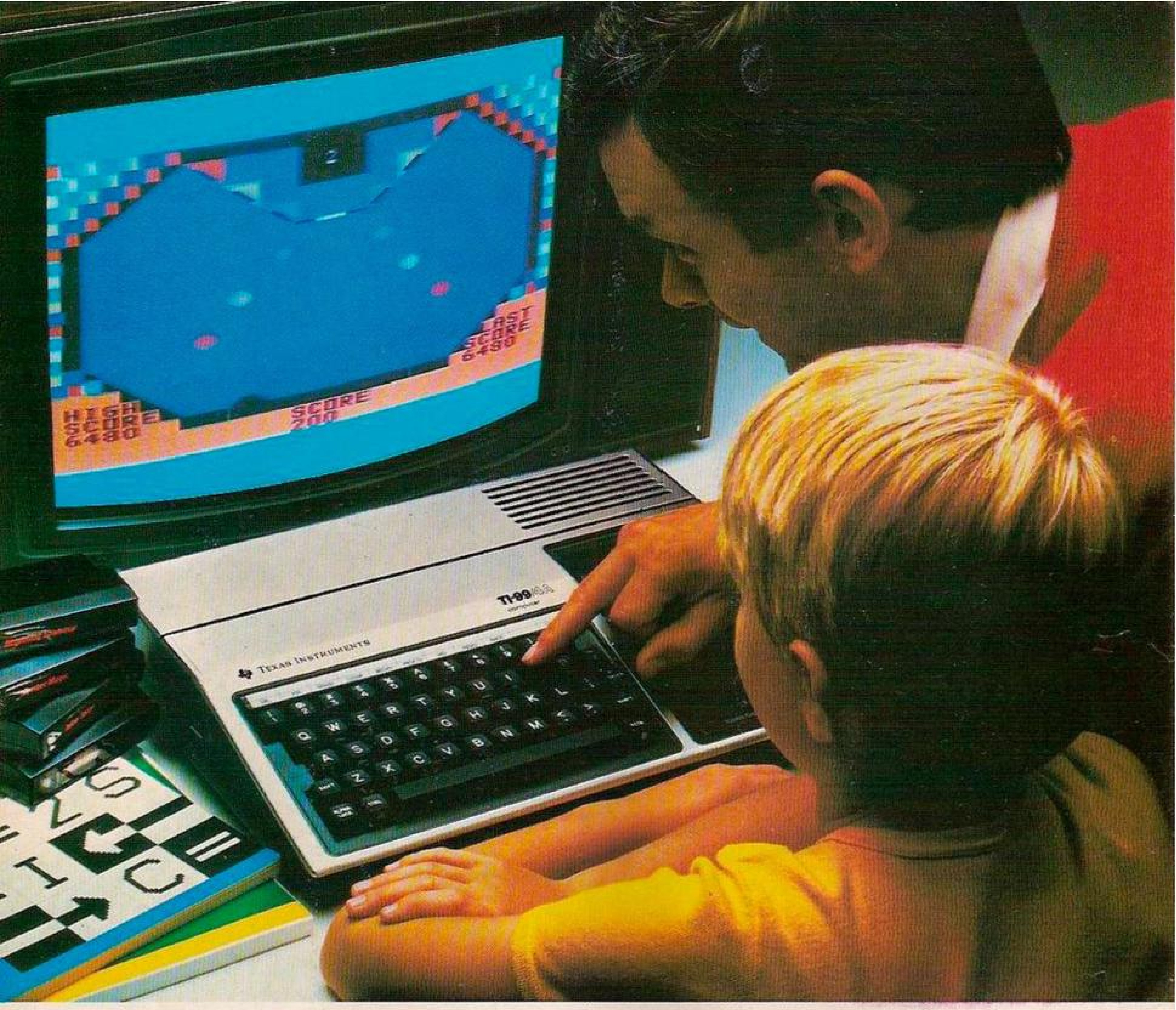
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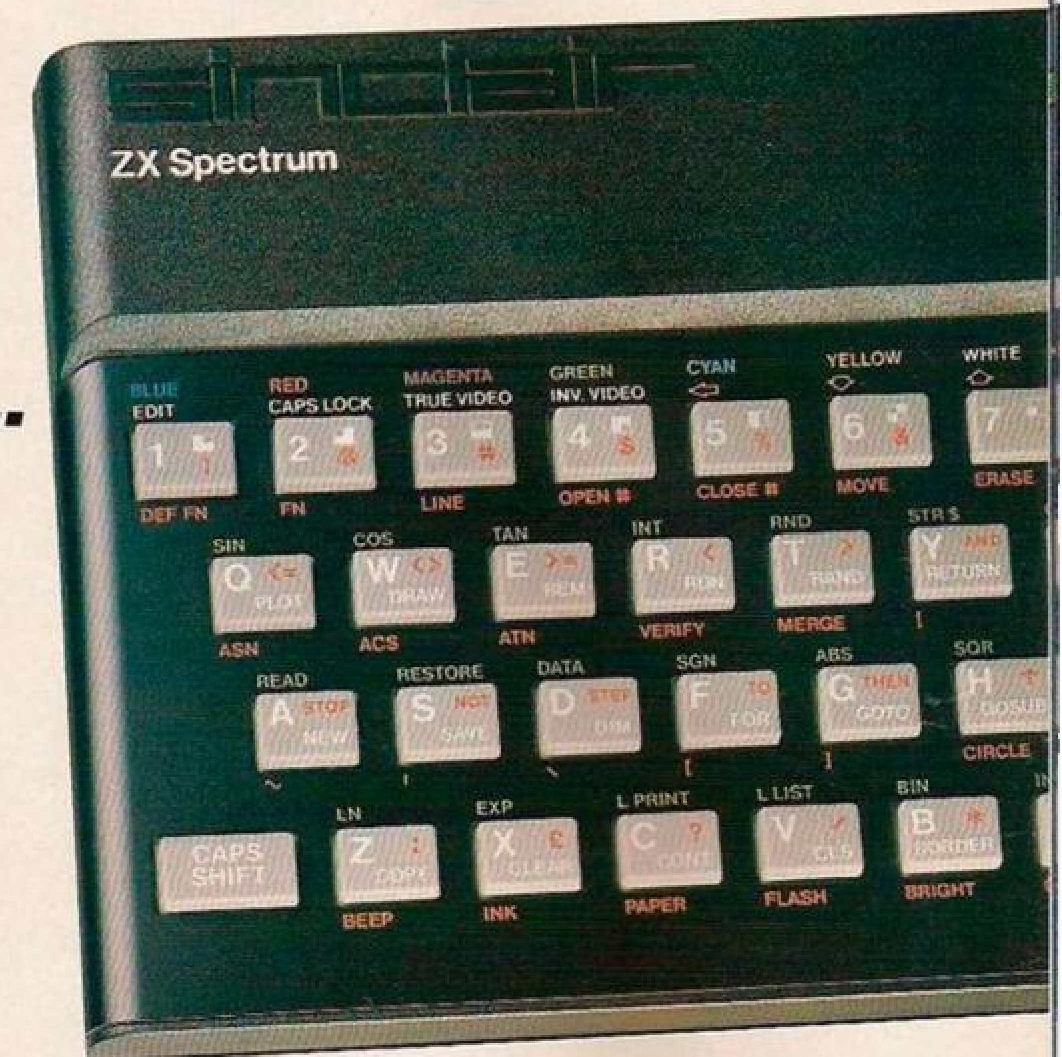
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YELLOW 6 & MOVE
WHITE 7 ' ERASE
8 (POINT
GRAPHICS 9) CAT
BLACK DELETE 0 _ FORMAT
SIN Q <= PLOT ASN
COS W <> DRAW ACS
TAN E >= REM ATN
INT R < RUN VERIFY
RND T > RAND MERGE
STR$ Y AND RETURN [
CHR$ U OR IF]
CODE I AT INPUT IN
PEEK O ; POKE OUT
TAB P " PRINT ©
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H ↑ GOSUB CIRCLE
VAL J - LOAD VAL $
LEN K + LIST SCREEN $
USR L = LET ATTR
ENTER
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
LPRINT C ? CONT PAPER
LLIST V / CLS FLASH
BIN B * BORDER BRIGHT
IN KEY$ N , NEXT OVER
PI M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

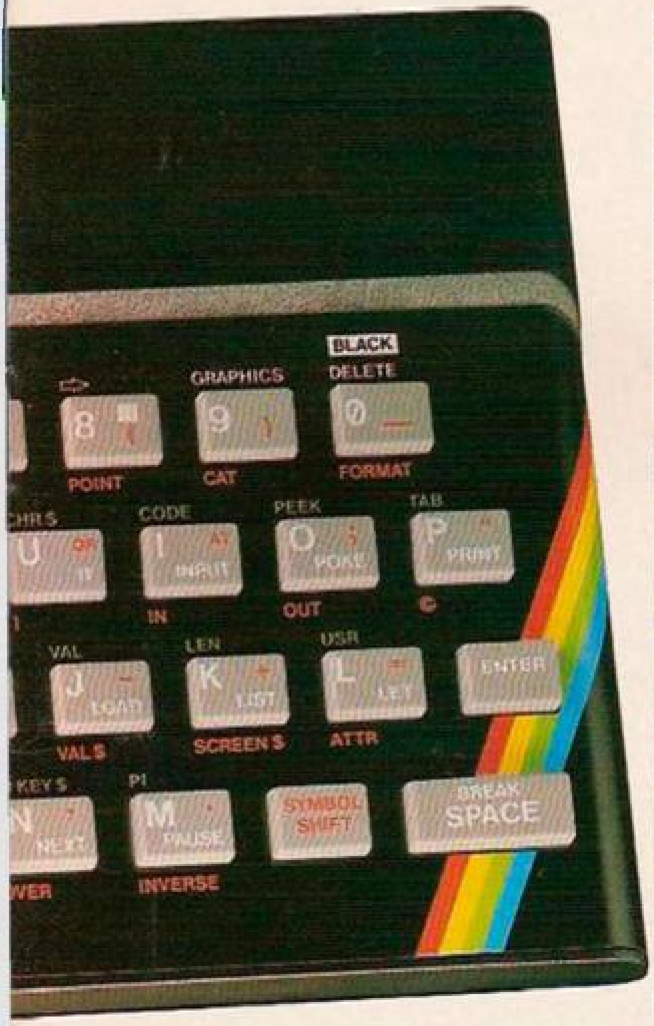
There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



ZX Spectrum software on cassettes – available now

The first 21 software cassettes are now available directly from Sinclair. Produced by ICL and Psion, subjects include games, education, and business/household management. Galactic Invasion...Flight Simulation...Chess...History...Inventions...VU-CALC...VU-3D ...47 programs in all. There's something for everyone, and they all make full use of the Spectrum's colour, sound and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

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Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS. Tel: Camberley (0276) 685311.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GUI5 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £______

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

YOC812

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

Sinclair ZX Spectrum–technical data.

Dimensions
Width 233 mm
Depth 144 mm
Height 30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive-or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair
ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

NOT A BUG

Concerning the "Spectrum Bugs" in the October *Your Computer* letter from Mr Dixon. He says that

```
CLS : PRINT CHR$ 8; "X"
```

produces two black squares. If he reads his manual the instruction CHR$ 8 means back space. Back spacing at the beginning of a line means moving into the address held for Newline. This corrupts the display file.

Secondly, when asked by the program Scroll?, normally one is expected to reply Yes or No, not with a Caps Shift. It is like saying my motor car has a bug, because although the road turns to the left I turn the wheel to the right and I do not make it round the corner!

I have found the Spectrum to be a good machine for its price.

B G Cornhill, Aylesbury, Buckinghamshire.

LOSS OF FAITH

It seems simple enough:— "Number on waiting list/weekly production = time in week of despatch". How, then, is it possible that the pioneer of the electronic calculator is unable to provide sensible delivery dates for the Spectrum?

My own order, after more than 16 weeks, is now cancelled. A telephone query after 14 weeks elicited "Any time now". After 15 weeks, I was back to "About another three weeks". After nearly 17 weeks, I was still at "2 to 3 weeks".

Like Mr Bloxham — *Your Computer*, October — I elected to order the Spectrum because of the expected Microdrive; also the wish to retain the use of my ZX Printer. Unlike Mr Bloxham, I do not believe in Sinclair any more, and the thought of going through the same hassle when the Microdrive is launched is too much.

Your leader postulating the possible decline of the British computer industry — in the same issue — is unfortunately both accurate and timely.

E R Keevy, Pulborough, West Sussex.

HANDICAP AID

We are a Cheshire Home for the physically handicapped and are building a library of programs for disabled computer users. We already have a number of Apple, Pet and TRS-80 programs. All of these programs will become available to anyone sending a stamped addressed envelope to the address below.

Most of the programs we have are operated using a two-switch system. For example: with the Apple we use the two switches on the games paddles. These switches can be used to mean anything from Yes/No to selecting from a menu where a flashing cursor scans from item to item and you press one button when the cursor is over the item you have selected. The other button can be used to correct errors or Escape.

If a scanning system is used the speed of scanning must be selectable.

Where possible one button should be available to Gosub to a scanning Help menu.

Any program you write must be easy for you to operate. Try it out on one or two friends first.

We would like to see any programs from adventure to chess, from databases to educational. The scope is unlimited, but please bear in mind that many handicapped operators have restricted vision and the display needs to be extremely clear.

If you have any programs to add to our Library or want a catalogue of the programs we have to date, or would like some further guidelines on how to write programs for the handicapped, please write, enclosing a stamped addressed envelope, to:

Robin Nixon, Seven Springs Cheshire Home, Pembury Road, Tunbridge Wells, Kent TN2 4NB.

WORD PUZZLES

I particularly liked the Word Puzzles program by Chris Callender on page 94 of your October issue. It has many educational applications. However there were a few errors in the program.

The following lines should be inserted to get it to run correctly:

```
43 SCROLL
45 PRINT T
75 SCROLL
```

it is also enhanced if line 530 reads

```
PRINT T$,, "FIND THE FOLLOWING
HIDDEN WORDS"
```

Missing from line 620 is −1 which should appear as shown here:

```
620 IF S$(AK>""THEN PRINT AT INT
   (A/16) ,A −16*INT (A−16) −1;
   CHR$ (CODE S$ (A) + 128)
```

The program also takes an interminable time to produce its letter grid. This can be speeded up considerably by adding the following lines.

```
185 FAST
585 SLOW
```

J Bourne, Bexhill on Sea, Sussex.

THE REAL STORY

I think it's about time you got the record straight. Contrary to popular belief, the BBC Model A can have eight colours on the screen at once. This is proved by the following program:

```
1 MODE 7: FOR I = 129 TO 135
10 PRINT CHR $(I);"Your Computer":
   Next
```

In the new almost-legendary Sinclair pamphlet, there is a table showing a list of computers and their specifications. This has to be the most biased and untrue table of all time. It states that the BBC can only have up to 32K RAM. This is not true. It can have 96K RAM via a second processor.

It states that the Vic and BBC do not have user-definable graphics; they do. The Vic can also have high-res graphics via a software routine. The BBC does have merge and verify facilities, which are under different names to the Spectrum.

The pamphlet does not state that the BBC has a built-in assembler, ROM expandable to 256K, a Plot command with 43 different functions, high-res graphics with 163,840 different points, a Pling command, and a microprocessor running up to five times the speed of the Spectrum.

J V Price, Chorley, Lancashire.

ZX-81 START

I have a 16K RAM ZX-81 and I have found the starting and finishing addresses for the screen. They are:

```
START 49340
FINISH 50066
```

Poke 49340, 38 would be the same as

```
PRINT AT 0, 0; "A"
```

Patrick Couser, Berkhamstead, Hertfordshire.

BBC FACTS

In Tim Langdell's article concerning the use of control keys on the BBC computer he says that where a VDU statement takes several bytes after it, the control version does not produce readily predictable results. It is not as bad as his article suggests. Consider his example, VDU19,1,4, 0,0,0 which changes logical colour 1 to show blue. First the CTRL solution, then the understanding.

Get something on the screen using logical colour 1. For example:

```
MODE4:COLOUR1 return
PRINT"This is logical colour 1" return
```

Now holding CTRL down while all of the next six keys are pressed, type SAD@@@. Nothing will appear on the screen, but as soon as the third @ is pressed the colour change takes place.

To know what to press after the first letter, use the left-hand two columns of figure 1 in the article: CTRL A has generated the 1, CTRL D the 4, the CTRL@, the 0.

Now the understanding. It will be helpful to find the diagram for keyboard codes on page 497 of the new manual and to type each of the following statements:

```
PRINT"01AB"
PRINT CHR$(48);CHR$(49);CHR$(65);
   CHR$(66)
VDU 48,49,65,66
PRINT CHR$(&30);CHR$(&31);
   CHR$(&41);CHR$(&42)
VDU &30,&31,&41,&42
```

Compare these hexadecimal codes with those in the keyboard code diagram. All these have the same screen effect as typing 01AB — without return — on the keyboard.

The reason is that whatever code is produced by the keyboard, it is sent to the VDU drivers. Codes 32(&20) to 126(&7E) cause the ASCII characters to be displayed. Codes 0(&0) to 31(&1F) are interpreted as control codes. However, if a control code needing extra bytes has just been received then the next keyboard codes received will be treated as the data bytes rather than their usual meaning.

CTRL S , 1 , 2 , of the article, then, is equivalent to VDU 19,44,49,44,50,44 — that is VDU &13,&2C,&31,&2C,&32,&2C. No wonder the VDU driver is confused and not producing readily predictable results! Notice the commas — code 44 — are treated as data, and those dummy zeros for later expansions are now far from 0.

What we needed was to create data of 1,2,0,0 and 0. Looking at the keyboard codes shows CTRL A creates 1, CTRL B creates 2 and CTRL @ creates 0. Because CTRL S always has five data bytes, the VDU driver knows to treat the CTRL A etc. as data — rather than the usual printer meanings.

For VDU statements with no data, Tim is correct, the CTRL equivalent is quick and easy; for VDU statements where data is always below 31, the left-hand two columns of figure 1 of the article enables predictable results with little effort; where data can go beyond 31, the keyboard code diagram — or the ASCII tables before it — and a knowledge of hexadecimal is needed: for data larger than 127, life can be even more difficult, though later operating systems allow Shift-Function, CTRL-Function, and Shift-CTRL-Function combinations to create whatever codes you like — see *FX225 to *FX229; page 439.

The principal advantage of these is for getting teletext control codes — ASCII 128 to 159 — input directly from the keyboard without wasting *Key definitions, rather than Print and Copy required by OS 0.1 users.

Finally, a couple of other points. Remember when defining a function key, the split vertical line preceding a capital letter indicates a CTRL code, so ¦B is "enable the printer". To get a teletext code use the fact that ¦! adds 128 to the next code so ¦!¦B is code 128+2=130, that is, "use green letters".

Codes 0 to 31 cannot generate user-defined graphics characters, but Acorn has used the syntax for redefining character 0 to give the user access to the registers in the CRTC — typical Acorn design philosophy — permitting custom-built modes, paged screens and more — see *BBC Micro Revealed* by Jeremy Ruston for more details.

P K Chilvers, Milton Keynes, Buckinghamshire.

Christmas tidings cheer those micro Scrooges

PLUMMETING HARDWARE prices are a phenomenon of the micro market. *Your Computer* checked out just how cheaply you could buy a home computer this Christmas. All prices include VAT.

The Texas TI-99/4 is an extreme example. In 1980 it cost £750 — today it can be obtained for £150 under a cash-back scheme. Apart from its 16-bit processor and typewriter keyboard, the Texas has much in common with the Atari 400: both have 16K, three-tone sound, 16 colours, sprite graphics and plug-in software. The 400 is now £200. By shopping around you could find a 3.5K Vic-20 for less than £140 rather than £200 earlier in the year. Even Mettoy's 32K, 9-colour Dragon 32 costs £180 from some



stores, instead of the £200 official price. The 16K Colour Genie is still £200.

Multitech's MPF II Apple-impersonator costs £270 for 64K. Also chiming in at 64K is the £350 Commodore 64 although delivery before Christmas could not be guaranteed. Computers £225 Lynx which has 48K and will be capable of running CP/M will also be available in numbers in the new year as will the £100 16K Oric, one of the first machines to break the £100 colour and sound barrier. Sanyo's PHC-25 20K Spectrum basher is unlikely to be in the stores until February, while the Spectrum itself is still good value at £125 for 16K or £175 for 48K.

If you still see the world in black and white, Jupiter's monochrome Ace runs fast as a purpose-built Forth machine for £90, and of course the ZX-81 now costs £50 made-up or £40 as a kit for a truly basic approach to programming.

Love on a hot ZX-81

LOVE ON A ZX-81 sounds quite uncomfortable, but this Love is an adventure game with a difference for machines with the 16K RAM pack. It is written by women for women. Remsoft, the distributors, maintain it will take men a while to get the hang of it.

The scene is set at a country house in Devon where you encounter Tom, your lifelong heart-throb. The game proceeds on the basis of your emotional response to people and situations. The authors say they have written Love for people who are more interested in playing than winning. It is available at £5.95 post paid from Remsoft, 18 George St, Brighton BN2 1RH. Telephone 0273 602354.

Cunning Lynx avoids mail-order snares

YOU WILL NOT have to wait much longer for the Lynx. Sales Director Riva Gould is confident that at least 1,000 computer enthusiasts will wake up on Christmas morning to find Camputers' new £225 machine in their stockings. This is just as well because Dick Greenwood, Camputers' General Director describes the Lynx as "a modern-day train set plus the Encyclopaedia Brittanica." Just the thing for Christmas.

So far Camputers has resisted the temptation to sell the machine by mail order, partly because of the bad reputation that computer mail order has for late deliveries. The Lynx will go on sale in selected High Street stores later this month. In the spring Camputers will make available disc drives and CP/M for owners who want to upgrade their machines so that they can run packages like VisiCalc. Greenwood envisages owners building up to a complete system of computer, printer, disc drive, light pen, modem, and software for around £1,000 all told.

Rather than using a Microsoft Basic, Camputers used a custom-built language by Davis Jansons. Jansons modestly describes his creation as "maybe not the best in the world" and points out its shortcomings. "It does not scroll and



it has no string arrays." On the other hand Davis Jansons is confident that the ease with which his language can be adapted to the needs of particular users, the machine-code monitor, and what he describes as "maths overkill" makes the Basic more useful than on any comparable machine. He is also working on an extended Basic and a Forth, which will be available for the Lynx from the Spring.

Now Forth speakers will be able to consult the Oric in their own tongue

ORIC EXPECTS to break the £100 colour and sound barrier this month by delivering 1,000 16K machines before Santa gets his boots on. Demand has greatly exceeded Oric Products' expectations.

Plans to sell 50,000 units in the first year have been redrafted after receiving orders for 30,000 in the first two months.

Cynics might expect this to produce Sinclair-style delivery delays but Steven Mountford, Oric's U.K. sales manager says "We are going to be very careful not to oversell".

Prospective buyers will be encouraged by Oric's latest language packages, Forth and Extended Basic. Forth will be offered free on cassette with every 48K Oric. It loads into RAM and takes up around 10K.

The Extended Basic comes in a ROM chip which will replace the existing Basic. It will be launched in January together with the modem and the free telesoftware service and will cost £34.50.

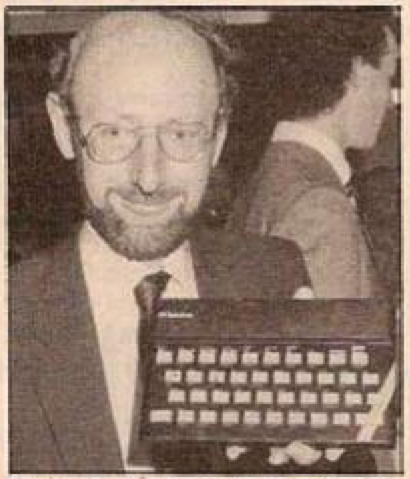
Peter Halford who has written the new Basic says that it is at least as powerful as BBC Basic. Like David Simons who has written Simons Basic for the Commodore 64, he has included all the commands found in other Basics plus some extra features such as a built-in assembler and disassembler. Full information from Oric Products International, Cosworth Park, London Road, Ascot. Telephone 0990 27641.

Wait for it — here comes the Microdrive

THE GOOD NEWS is that Spectrum delays are shrinking to reasonable limits, the bad news is that now you will have to wait even longer for the Microdrive. Despite repeated announcements that the Microdrive and RS-232 board for the Spectrum would be available by the end of this year, they are now unlikely to be launched before February 1983. The arrival of the first Spectrum Prestel adaptor of Spring is now not expected until the middle of 1983.

This news may confirm the view of some people that Sinclair Research operate on a different time scale from the rest of us. In Sinclair Time 28 days can embrace a period stretching from one to three or even four months.

Sinclair has recently been rapped on the knuckles by the Advertising



Standards Authority for consistently failing to deliver Spectrums within the advertised 28-day limit. The ASA was inundated with an unprecedented number of letters complaining about delays.

YOUR COMPUTER TOP 10

Game	Machine	Company
Flight Simulation	ZX-81	Psion
3D Defender	ZX-81	JK Greye
Gulp 2	ZX-81	Campbell Systems
Orbiter	Spectrum	Silversoft
Meteor Storm	Spectrum	Quicksilva
Vic Panic	Vic-20	Bug-Byte
Amok	Vic-20	Audiogenic
Planetoids	BBC	Acornsoft
Defender	Atari	Atari
Ghost Attack	Dragon	Dragon

Artic has cracked it

RICHARD TURNER of Artic gives a wry smile if you try to make him give away the secret of Krakit — the Toronto based £10,000 competition which has caught the imagination of Sinclair computer riddlers in Britain and America.

The puzzle consists of 12 riddles, each of which contains the name of a country, a date, and a city. Richard Turner gives an example of how the riddles work.

"Look up 'Tour'. When was it first seen? No rhyme for hour but a rhyme for dance." The rhyme for dance is France, the 'Tour' is the Eiffel Tower in Paris and it was first seen when it was constructed — in 1889.

At £10.00 a copy, whoever wins, Richard Turner of Artic — which is distributing Krakit — is not going to lose.

Sharp sends PC-1251 to front line but keeps MZ-700 in reserve

SHARP PLANS to sell 250,000 a year of the new MZ-700 home computer launched this month in Japan. Sharp intends selling the MZ-700 worldwide but no date has been set for the 64K RAM colour computer's British launch yet. The price is unlikely to be as low as the £180 quoted in Japan where an optional colour plotter/printer costs £100.

Meanwhile in Britain Sharp is launching a new range of pocket computers distinguished by an optional integrated printer and microcassette recorder. The PC-1251 features an 8-bit CMOS CPU, 4K RAM and extended Basic for around £80. What makes the PC-1251 more interesting than most pocket computers though is the CE-125 printer and microcassette recorder which transforms it into an low-power lost-cost rival to the Epson portable computer. The whole unit is only 8in. wide, 6in. deep and 1in. high.

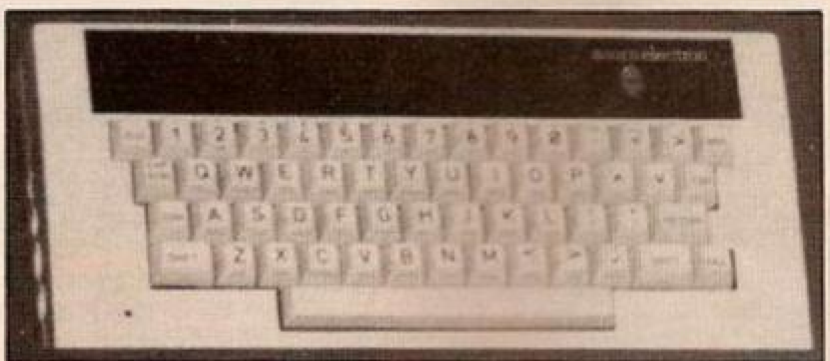


First glimpse of Acorn's Electron — the 32K £150 Spectrum rival

ACORN'S EAGERLY AWAITED Electron has joined the select band of microcomputers which are already late before they are even officially launched.

Until last month Acorn was still confident that the 32K Spectrum basher with full BBC graphics capabilities would be on sale before Christmas. Now the familiar ULA problems which have haunted Acorn in the past are again holding up production of the £150 Electron.

Acorn hopes to launch the machine early in the new year but if it becomes necessary to update the specification — for instance the single-channel sound capability or the relatively slow processor, further delays cannot be ruled out. The cream-coloured machine has a real typewriter keyboard and measures 13in. wide, 6in. deep, and 2in. high.



ZX Printer for 6502s

Now 6502-based computers will be able to run the low-cost ZX Printer with Microtanic's new interface board. The board is suitable for machines such as the Vic-20, the Atom and the BBC Micro.

The £29.95 board is available now, and an interface for 6809-based machines like the Dragon 32 will be released shortly. Further details from Microtanic Software, 235 Friern Road, Dulwich, London SE22. Telephone 01-693 7659.

Chart-topping software makes games hit parade

AS THE SOFTWARE industry becomes more like the music business — complete with album covers for cassettes, *Your Computer* publishes its first Top 10, in no particular order based on sales from shops and manufacturers all over Britain.

Top of the list for the ZX-81 are Psion's Flight Simulation, JK Greye's 3D Defender and Monster Maze, Trader from Pixel, and Campbell System's Gulp 2. Adventure games are steady sellers, in particular those from Artic and Phipps. Former high-flier Mazogs from Bugbyte is said to be slipping down while DJL's Frogger is tipped for a place in next month's top five.

In the Spectrum range chart leaders are Bug-Byte's Spectral Invaders, Silversoft's Orbiter and the Quicksilva games, Meteor Storm and Space Invader. New entry, Escape from New Generation Software looks promising. Also selling well are Chromasoft's Adventure 1 and Startrek from Abersoft.

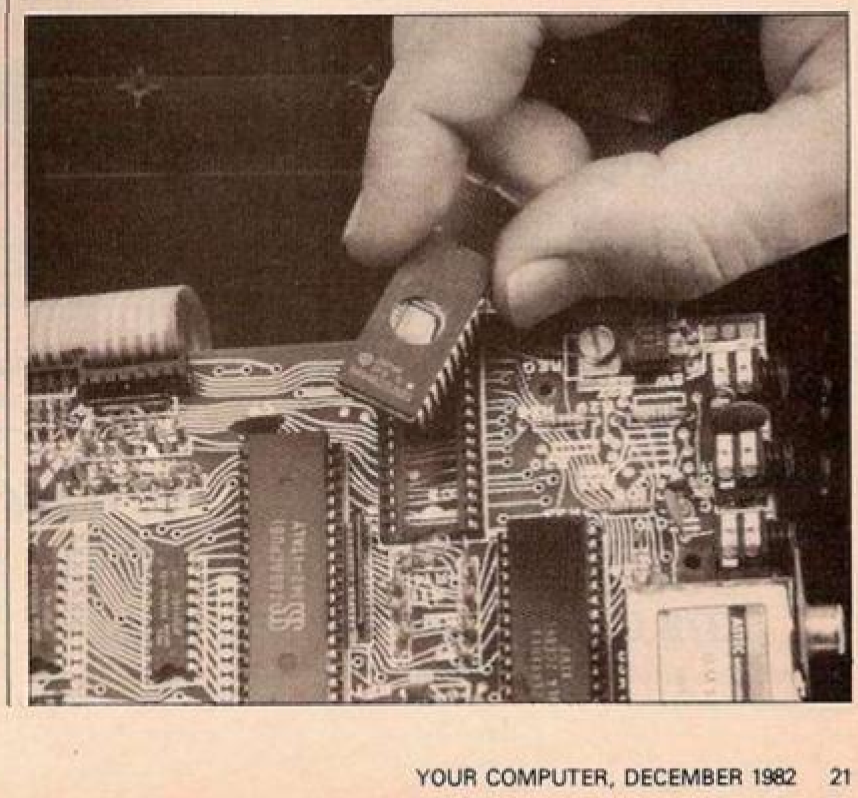
Top of the Vic-20 stakes were Vic Panic, Cosmiads and Another Vic in the Wall from Bug-Byte, and Bonzo and Amok from Audiogenic. Also selling well was Commodore's Blitz.

Dragon software is thin on the ground at the moment although Dragon's own programs, Ghost Attack and Beserk are moving up the charts. On the BBC front Acornsoft's programs are still the most popular especially Snapper, Planetoids and Monsters. Defender is taking over from Pac-Man as Atari's topper seller.

Stay with us next month for a new top 20 survey.

New ROMs for old is a common cry in computing. This Aszmic chip replaces the ZX-81/80's Basic ROM inside the case. Comprocsys claims it turns the ZX-81 into an Assembly Language Program Station. As well as a Z-80 assembler it supplies many other features, including an extensive screen editor, file handling system, and 255 by 144 graphics resolution.

Capital Computers, Comprocsys agent in this country, is developing a board which will take both the Aszmic and Basic ROMs and allow switching with a comprehensive manual from Capital Computers, 1 Branch Road, Park St, St. Albans AL1 4RJ. Telephone 0727 72917.



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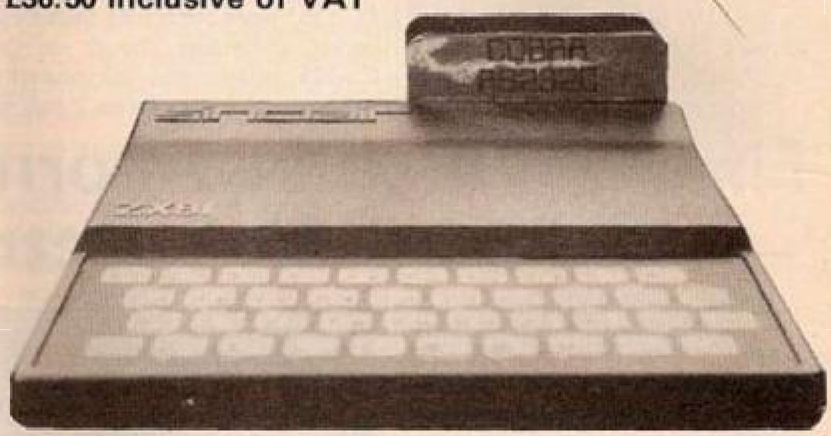
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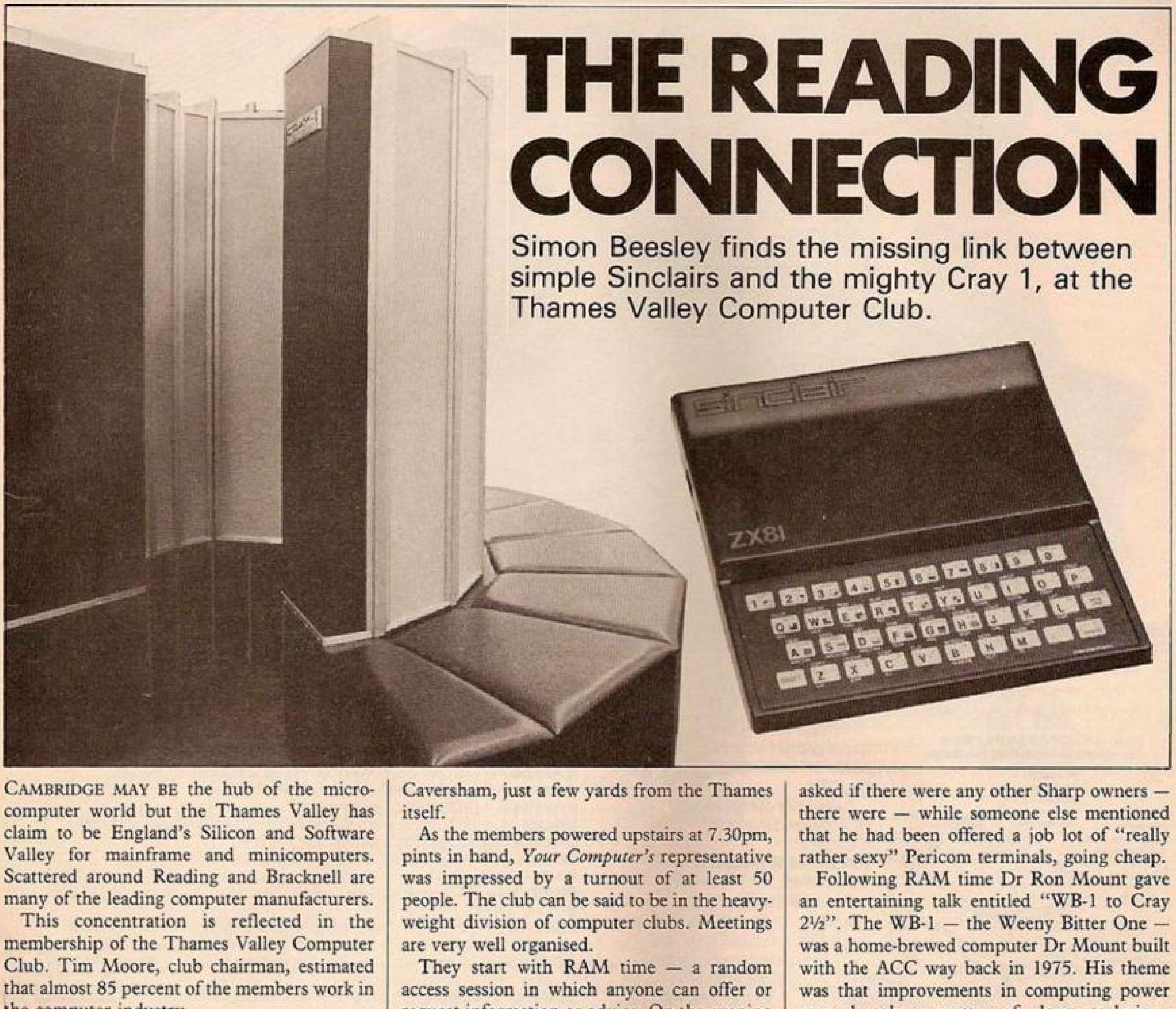
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COMING SOON!

Watch this space for details of the Spectrum Microdrive interface for the 2×81 and others



Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.



THE READING CONNECTION

Simon Beesley finds the missing link between simple Sinclairs and the mighty Cray 1, at the Thames Valley Computer Club.

CAMBRIDGE MAY BE the hub of the microcomputer world but the Thames Valley has claim to be England's Silicon and Software Valley for mainframe and minicomputers. Scattered around Reading and Bracknell are many of the leading computer manufacturers.

This concentration is reflected in the membership of the Thames Valley Computer Club. Tim Moore, club chairman, estimated that almost 85 percent of the members work in the computer industry.

The club meets upstairs at the Griffin, Caversham, just a few yards from the Thames itself.

As the members powered upstairs at 7.30pm, pints in hand, *Your Computer's* representative was impressed by a turnout of at least 50 people. The club can be said to be in the heavyweight division of computer clubs. Meetings are very well organised.

They start with RAM time — a random access session in which anyone can offer or request information or advice. On the evening *Your Computer* visited the club a newcomer asked if there were any other Sharp owners — there were — while someone else mentioned that he had been offered a job lot of "really rather sexy" Pericom terminals, going cheap.

Following RAM time Dr Ron Mount gave an entertaining talk entitled "WB-1 to Cray 2½". The WB-1 — the Weeny Bitter One — was a home-brewed computer Dr Mount built with the ACC way back in 1975. His theme was that improvements in computing power were largely a matter of clever technique rather than new technology. From the WB-1 via the PDP-11 to array processors, he showed their hardware architecture to be recognisably similar and the technology almost the same. Yet while the WB-1 could perform 100,000 operations per second and the latest PDP-11s a million instructions a second — matched by some micros — array processors can handle up to 12 million a second.

Dr Mount finished by describing the Cray-1 which performs 167 million operations a second.

As many people attend the club's Special Interest Groups as their main meeting. These meet elsewhere on other days and include groups for the Z-80 and the 6502 processors. The Z-80 group has been working on a cassette interface to enable programs to be passed between different machines like the Nascom and TRS-80.

There is also a basic Basic group for beginners. Details from Phil Warn on Reading 594874 or Roger Bird on Newbury 43855.■

Local society news

ZX-Aid Walsall

ZX-81 AND Spectrum owners are invited to attend the meetings of ZX-Aid, a Sinclair users' club which meets on the first and third Thursdays of the month in a local church hall. Plans are afoot to for competitions, machine-code courses and hardware projects. Telephone Conrad Roe on Walsall 25465 after 6pm for details.

Bangor and District

BANGOR and District Microcomputer Users' Group meets fortnightly at the Bangor Community Centre, High Street, Bangor. Details from Dilwyn Jones, Fodol Farm, Hafod Lane, Bangor.

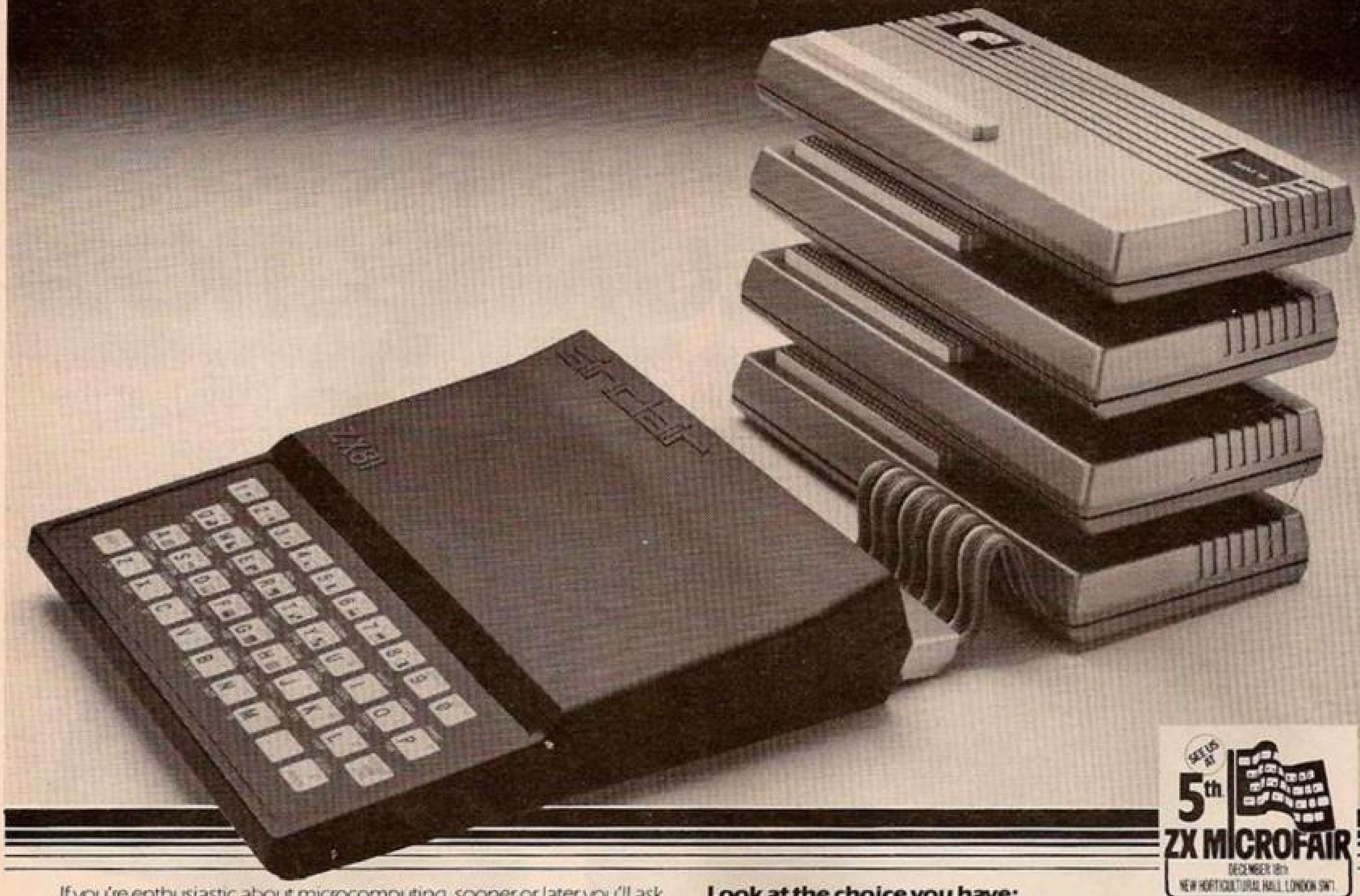
Micros in Perth

THE PERTH and District Amateur Computer Society has been formed recently and meets on the third Tuesday of each month at Hunters' Lodge Motel, Bankfoot. Meetings start at 7.30pm and include a talk or demonstration. Contact Alastair MacPherson on 0738-29633 for more information.

West Midlands group

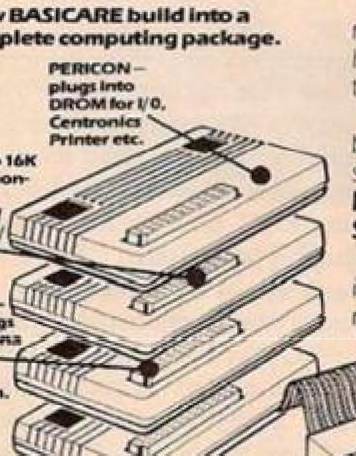
THE WEST Midlands Computer Group was set up in August this year and has already produced two issues of their magazine, *Databus*. They will be holding monthly meetings in Birmingham. Details from Steve Walker on 021-422 7405.

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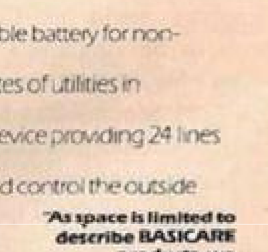
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FLEXIDISC



Three games are included on this month's *Your Computer* flexidisc, one for the ZX-81, one for the Spectrum and one for the Vic-20. Bill Bennett keeps you on the right tracks.

THE FEEDBACK we received after the first *Your Computer* flexidiscs revealed two facts. First, we discovered that you wanted us to provide software for a wider variety of microcomputer. We regret that it is just not possible to provide a disc for every machine on the market, but our latest disc does cater for three of the most popular home computers, the ZX-81, Spectrum and Vic-20.

The second revelation concerned people who could not get the first flexidisc to load: often they had not read the instructions. Some had even played the record upside down. This, then, is the first point to check. The software is recorded on the other side of the disc to the writing — so turn the disc over.

Make sure you select the right track for your computer. The first, and longest track is the ZX-81 game. To load it, you must have a 16K RAM pack. The program lasts over six minutes and is an adventure game based on *The Hitch-hiker's Guide to the Galaxy.*

At the end of the first two tracks is a special lock-groove. This is a groove which traps the stylus, and stops it from moving any further in towards the centre of the disc. The reason for this lock-groove is that it stops the accidental loading of the next track on the disc, which could have chaotic consequences.

To load either the second or third track, you must first position the stylus before letting the turntable move. On modern equipment, the best technique is to raise the recording arm, start the turntable and gently lower the arm into place. On older equipment try locating the stylus while holding the turntable still with your other hand.

If you decide to record to tape from the record player, rather than loading directly — the first option is the wiser — the best method is to turn the tape recorder on early. After you have recorded the software on to tape, wind it back and then listen to it. Make a note of where the actual program starts, rewind a fraction and load from there.

Having successfully loaded the program into your computer, you should once again copy it, to provide a back-up version.

The second two programs both last less than one minute. It is important that the instructions regarding locating the grooves are followed correctly, otherwise the program will not load. The Spectrum program loads in two halves, and is called Night Racer, the Vic program is called Antispace 2.

To load the Vic program, you must have the Commodore cassette unit.

Be prepared to spend some time loading the tapes; it is doubtful that you will get everything right first go. ■

Sleeve notes

- The disc has been cut in mono. If you can, transfer it to a mono tape recorder. If this is not possible, record on one track only of a stereo recorder by turning one channel right down.
- Ensuring that the level is right is perhaps the most difficult stage. If your equipment has VU meters, set one channel right down, and the other to a point less than zero dB.
- Remember the speed is 33 rpm.
- If you can use a mono stylus then do.
- Record the software from the disc with the same tape recorder you intend to use for loading the computer with. Sometimes recording heads on different cassette records do not actually line up, and so many sounds do not play back exactly as recorded.
- Look at the patterns on the screen when loading to Sinclair computers. You should be able to judge if the level is too high or too low.
- It is easier to type LOAD "" on the Spectrum and ZX-81, and just LOAD on the Vic-20.
- Finally, remember that the Spectrum program runs directly from Load. Also, expect the ZX-81 screen to go blank for a while as soon as it is run. If nothing happens after a minute, Break and look at the listing. Sometimes individual bits of the program can be corrupted on loading, but these are easily debugged once the program has been loaded.

REVIEW



SORD M-5



Made in Japan, but can Sord's £100 colour and sound micro make it over here. Tim Langdell tests its mettle.

HARD ON THE HEELS of the Sanyo PHC range we reviewed in October comes this new micro from Sord — Japan's fastest growing computer manufacturer. The M-5 is a Z-80A based micro with 8K of internal ROM, 4K of user RAM, and 16K of video RAM. It can produce up to 32 different colours on the screen at once, with a variety of resolutions from 32 by 24 up to 256 by 196. All this for £100 sounds almost too good to be true.

Externally the M-5 is beautifully designed and made to the high standards expected of Japanese electronics. It measures 10.5in. wide, 7.25in. deep, and 1.5in. high, which makes it slightly bigger all round than the Spectrum. The two-tone grey plastic casing opens to reveal a bright yellow back, which houses the ROM cartridge slot.

Stable and portable

The M-5 is heavier than it looks which makes it extremely stable whilst still being very portable. The keyboard is similar to the rubber matting of the Spectrum, but feels better. The keys are dark-grey with the letters and numbers sharply contrasted in white. Graphic characters are in bright yellow on each key, and have been designed to be easily visible without making the keyboard seem too cluttered.

There are two shift keys — one on each side — and these, along with a space and return key, are all larger than the other keys on the board.

The keyboard also boasts a control key, a function key and a reset key. Looking more closely it becomes apparent that most keys have a Basic keyword on them in small light-grey letters. These are difficult to see, which might be a problem for the first-time user but the keyboard is easy to use once learnt.

On the negative side, the keys are not placed at typewriter pitch as the Spectrum's are — but are about three-quarters typewriter size. This undoubtedly makes typing harder — although considerably easier than on the calculator-style keyboards of pocket computers. The keys also do not have very much travel, making key presses a little less positive than they might be. An automatic keyboard beep partly makes up for this, but does nothing to remedy the lack of a full-size space-bar.

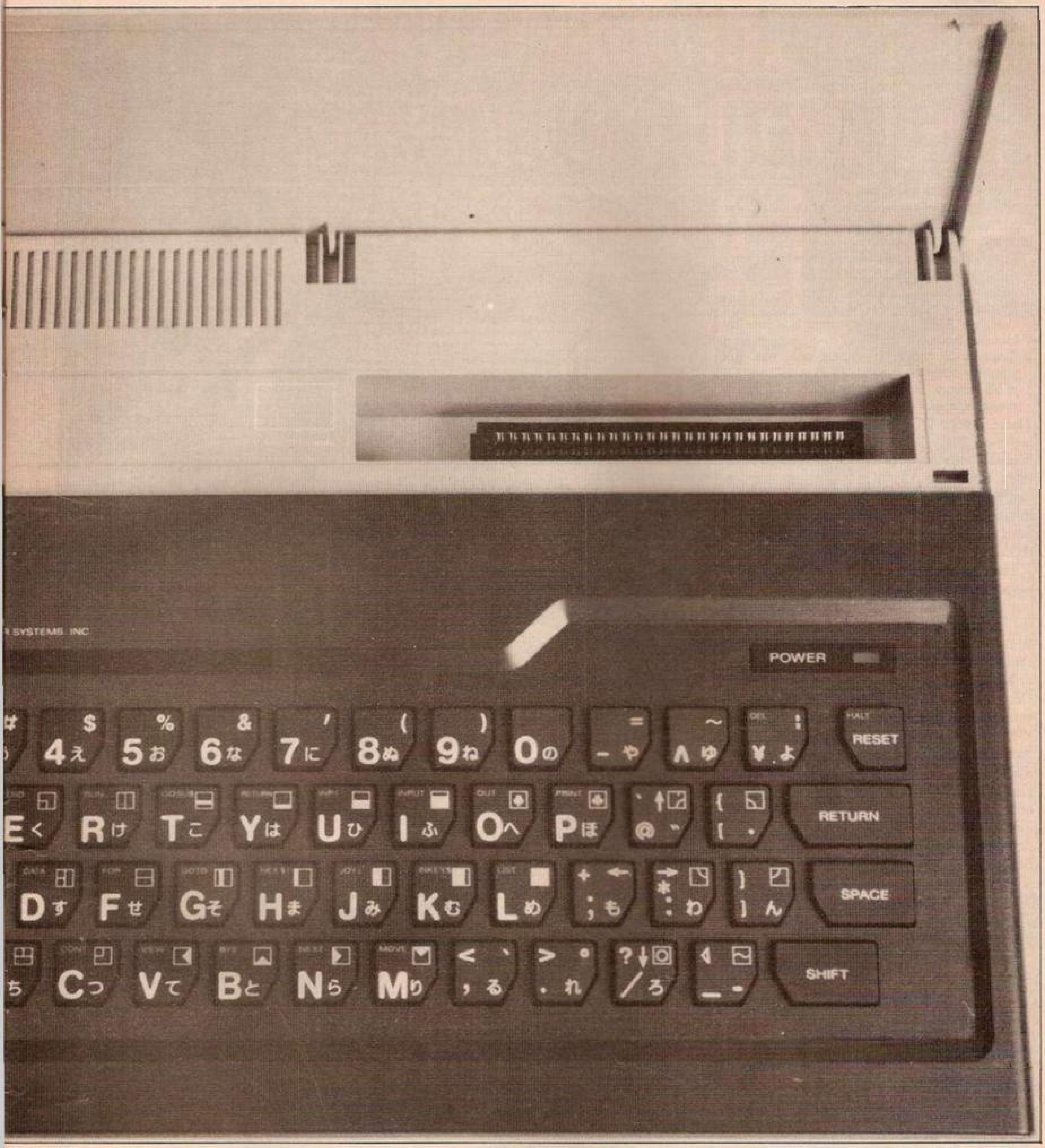
The Sord M-5 has single-key entry like the Sinclair. However, this is not its usual mode of operation, and far from all the keywords it recognises are on the keys. The M-5 responds like most micros, putting the letter or number on the key on to the screen rather than a keyword with the first key press. But single-key entry is quite easy by holding down the function key as the other key is pressed. The M-5 thus offers the best of both worlds.

What is puzzling, though, is why Sord has failed to put some keywords on the keyboard. For is there but To is not. Little-used keywords such as Auto, Renumber and Call are there, but If and Then have to be typed in.

The M-5 has 32 graphics symbols in ROM which speeds up games programming particularly.

The Sord's Basic is reasonably powerful supporting all the major keywords, as well as Read, Data and Restore, Renumber, Auto line numbering, Joy to read the joysticks, and Hex$ which converts decimal numbers to Hex. The Basic is supplied on a ROM cartridge rather than being resident inside the machine. This has the advantage that future enhancements can be sold in the form of a new Basic cartridge, but has the disadvantage that the unit is useless without a cartridge plugged in.

The Basic is more fussy than in Sinclair or



Microsoft-based computers such as the Dragon. Syntax checking is not done until the program is Run, and the error reports are very brief and hard to understand at first. They are of the form

ERROR 2 IN LINE 1

The keywords usually need a space after them, when Sord could have made the Basic automatically put them there. Let is understood but not necessary. However, it is added when a List is pulled. If you omit a space in a crucial spot the M-5 may assume it is dealing with a Let statement and insert Let in the program. This could be rather confusing for a beginner.

Minor criticisms aside, the Sord performed very well, being one of the fastest Z-80A-based micros I have seen in anything like this price range. The screen handling seems considerably faster than the Spectrum's for instance, and the demonstration ROM's fast-moving graphics confirmed this impression. One program showed an entire screen, full of information being smoothly scrolled at a fair rate, and large spacecraft being moved fast and smoothly across the screen which is not easy on many computers — even in machine code.

The Sord has at least two screens which can be written to independently. Up to 32 graphic shapes or sprites can also be defined and called at will to create cartoon effects and very smooth graphic movement. The M-5 has four modes of operation in addition to the sprite mode. The sprite mode allows the super-

(continued on next page)

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imposition of screens so that one is seen through another. In this manner the demonstration program showed a constant background of Mount Fuji with the letters comprising Sord moving smoothly around the screen.

The other four modes are:

- Text-only mode with no colours and a 40 by 24 screen display, each character made up of eight by eight character squares. This mode appears to be teletext-compatible in its format but not in its availability of colour.
- Graphics 1 mode in which the screen is mapped in eight by eight pixel character squares on a 32 by 24 grid with a possible 32 colours available.
- Resolution of 64 by 48 with 16 colours available. Each character square is a four by four dot matrix.
- Graphics 2 mode in which one has full graphics with a resolution of 256 by 192 and up to 32 colours. However, only two colours are available in any given character square.

There is only 4K of internal RAM, while the memory map is labelled in the Japanese manual with most of the remaining area as extra external RAM/ROM — which implies that Sord has extension RAM cartridges in mind. Certainly other languages such as Pips, Sord's equivalent of VisiCalc, are available on ROM.

The M-5 seems well equipped for the games player with joysticks and plug-in ROM games, but also well suited to the more serious user if the memory can be expanded. It has both a television output at the rear and a video and sound output. The joysticks simply plug into tiny DIN sockets, and there is a port for a Centronics printer. The power supply is external and rather cumbersome.

The M-5's sound capabilities are better than those on, say, the Dragon or the Spectrum. The Sord has three independent sound channels which can produce a variety of music and synthesised sounds. Again the demonstration cartridge showed off by depicting three animals on screen playing tunes in three voices complete with the striking of piano keys and bowing of a violin. The sound benefits from being sent via the TV or video system rather than from an internal speaker.

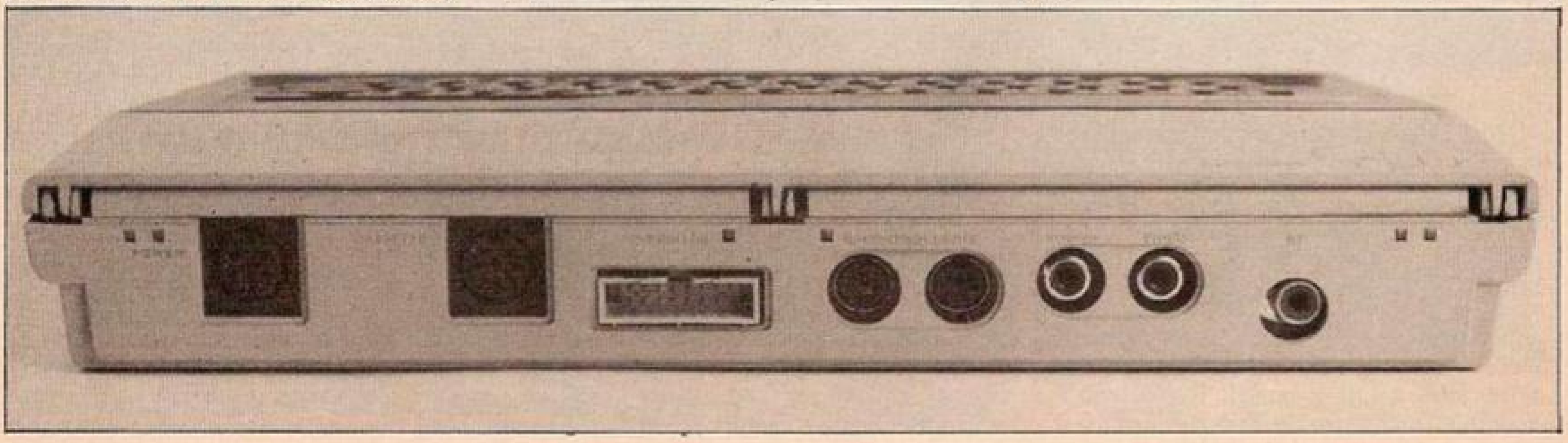
The M-5 supports Inp and Out in Basic to control Z-80A ports, but has no obvious connector to the external world other than the ROM cartridge slot into which the Basic must be inserted. This makes it unlikely that it could support a disc-drive or control equipment via I/O ports unless a custom-made unit will be made available to sit in the ROM socket.



CONCLUSIONS

- For £99.99 the Sord M-5 will be a strong contender in the home computer market when it becomes available next month.
- Stylish appearance and compact design could make it look attractive on the High Street.
- Games players will be attracted by plug-in software, joysticks, and definable sprites.
- The more serious user may be attracted by a fast Basic which has many useful characteristics such as Renumber and Auto, and by the presence of a Centronics interface and video outputs.
- 4K of internal RAM is inadequate. Sord would be well advised to consider a RAM upgrade cartridge to compete with the bigger memories of the Spectrum, Oric and the other colour micros in the £100 range. ■





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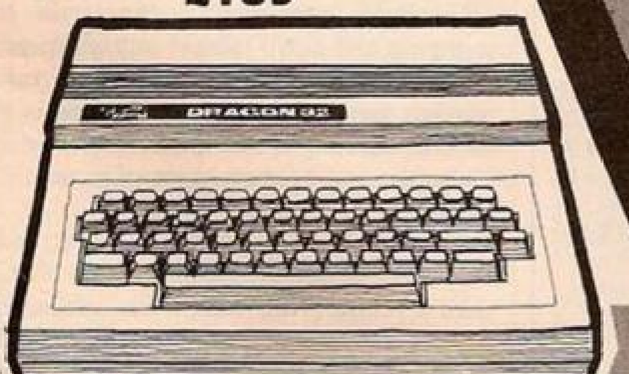
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SURVEY
VIC SOFTWARE

Neville Ash provides a yuletide round-up of all that is best in Vic-20 software

PROGRAMS FOR THE Vic come in two main types: cassettes which range in price from £5 to £10 and have the slight drawback of slower loading, or cartridges which give almost-instant loading — but can cost up to four times more than a cassette.

What about floppy discs for the Vic? They are available at just a couple of pounds more than cassettes, so they appear the perfect choice. The only problem is the price of a Vic disc drive — around twice the price of the computer.

However, once 3in. and 3.5in. discs arrive on the market, companies like Commodore may be forced to reduce the price of their disc drives in order to compete.

Company	Program	Cassette	Cartridge	Extra memory	Price
Applied Systems Knowledge	Facemaker	Yes	No	16K	£8.95
London House,	Number Chaser	Yes	No	16K	£8.95
42 Upper Richmond Road,	Number Gulper	Yes	No	16K	£8.95
London SW14 8DD.	We Want to Count	Yes	No	16K	£8.95
	Twister	Yes	No	16K	£8.95
	Rainbow Towers	Yes	No	16K	£8.95
Audiogenic Ltd,	The Alien	Yes	No	3K	£7.99
PO Box 88,	Amok	Yes	No	None	£6.99
Reading,	Kosmic Kamikaze	Yes	No	3K	£7.99
Berkshire.	Star Wars	Yes	No	None	£6.99
	Renaissance	No	Yes	None	£24.99
	Meteor Run	No	Yes	None	£24.99
	Satellite and Meteorite	No	Yes	None	£24.99
Bug-Byte,	Asteroids	Yes	No	None	£7.00
98-100 The Albany, Old Hall Street,	Another Vic in the Wall	Yes	No	None	£7.00
Liverpool L3 9EP	Backgammon	Yes	No	3K	£7.00
	Cosmiads	Yes	No	None	£7.00
	Panic	Yes	No	None	£7.00
Commodore,	English Language	Yes	No	8 or 16K	£9.99
675 Ajax Avenue,	Mastermind	Yes	No	8 or 16K	£9.99
Slough Trading Estate,	— plus subject tapes	Yes			£1.99
Slough,	Quizmaster	Yes	No	8 or 16K	£8.00
Berkshire SL1 4BG.	Adventureland	No	Yes	None	£24.95
	The Count	No	Yes	None	£24.95
	Mission Impossible	No	Yes	None	£24.95
	Pirate Cove	No	Yes	None	£24.95
	Voodoo Castle	No	Yes	None	£24.95
Llamasoft, 49 Mount Pleasant, Tadley, Hampshire RG26 6BN.	Grid Runner	Yes	No	None	£5.00
Postern,	Siege	Yes	No	None	£6.99
PO Box 2, Andovers Ford, Cheltenham, Gloucestershire GL54 5SW.	Shadowfax	Yes	No	None	£6.99
Rabbit Software,	Hopper	Yes	No	None	£9.99
380 Station Road,	Myriad	Yes	No	3K	£9.99
Harrow,	Nightcrawler	Yes	No	None	£9.99
Middlesex HA1 2DE.	Space Phreeks	Yes	No	None	£9.99
	Space Storm	Yes	No	None	£6.99
Romik Software,	Mind Twisters	Yes	No	None	£9.99
24 Church Street, Slough SL1 1PT.	Multisound Synthesiser	Yes	No	None	£9.99
	Sea Invasion	Yes	No	None	£9.99
	Shark Attack	Yes	No	None	£9.99
	Martina Raider	Yes	No	None	£9.99

Audiogenic's games are supplied in both cartridge and cassette form and we had samples of games in each form. Three cartridges were supplied — one would not fit until pushed very hard into the slot at the back of the Vic; in fact it started to come apart. Even so its performance was not affected.

The three games supplied were Renaissance, a joystick version of the popular game Othello; Satellite, a game similar to Asteroids with excellent graphics; and Meteorite, similar to Defender but a well-implemented example of this type of game.

Audiogenic also supplied four games in cassette form. Cosmic Kamikaze, a game similar to Invader 4 — Space Invaders with mountains — is available in two versions, one for an extra 3K and the other for an extra 8K. This is a slow game that records the number of shots as you fire.

Amok is similar to Super Robots: you have to clear the space station of dangerous robots. You appear coloured purple and all the robots are green. It starts very simply, but once you reach the fourth level it is really difficult to win. Star Wars involved moving your space ship to the centre, then firing — not very challenging — and the last game — Alien — took longer to load than almost any other game and was still merely average.

Bug-Byte provided five different games in cassette form. Backgammon has three levels, with a realistic throwing of the dice, and could prove quite compulsive: good value.

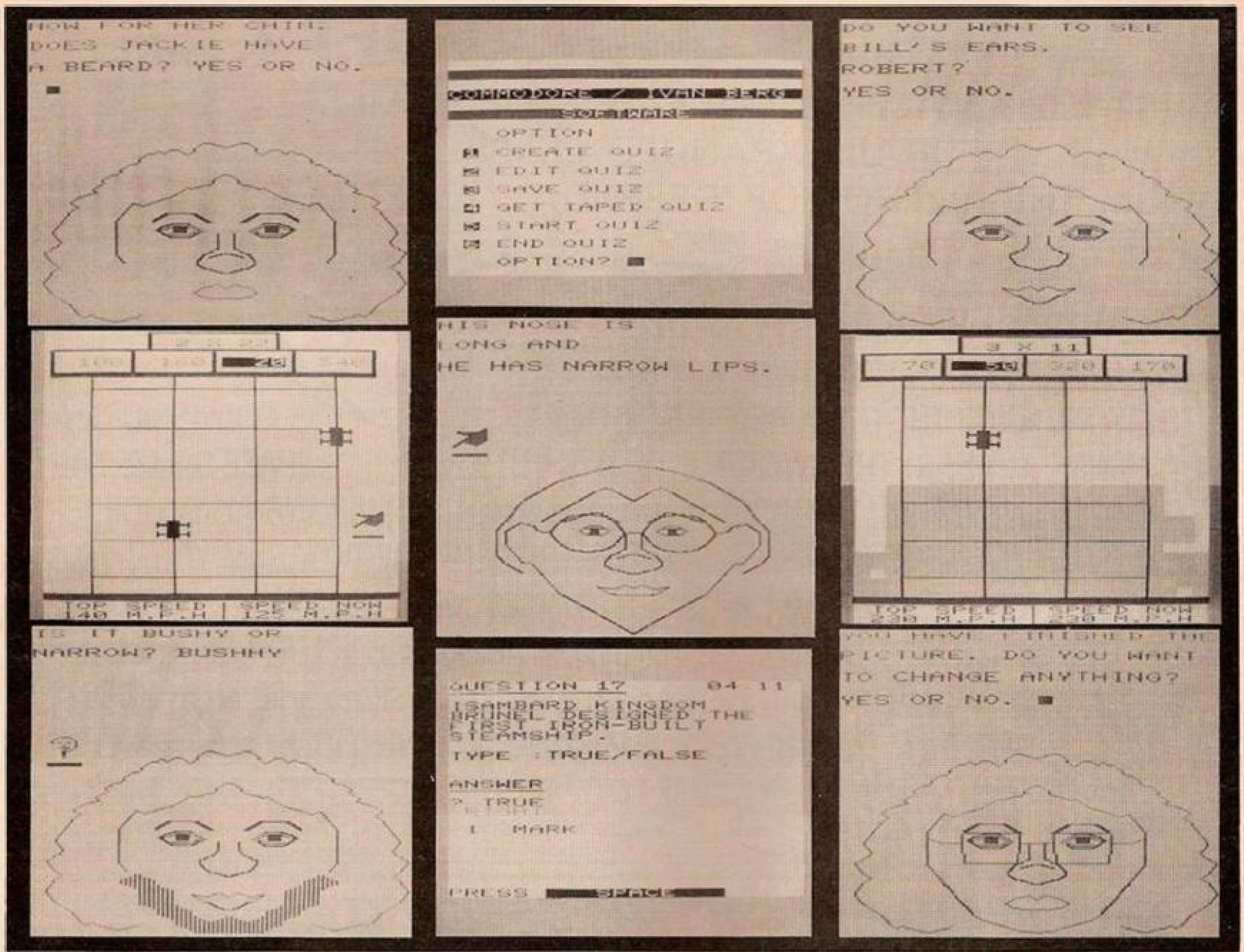
Vic Panic is as good as the arcade game, going up and down ladders at high speed and digging holes. It is very effective, a real fast-moving game. Bug-Byte's Cosmiads is really another version of that tried and tested game Galaxians and as these types of game go, it is slow.

Another Vic in the Wall is yet another version of Breakout, starting with a blue wall, then a yellow/green wall, it has left and right keyboard operation and paddles. Initially it seems far too slow, but as you progress it really speeds up. Asteroids is another old friend and is a good example.

Commodore itself had recently started promoting a wide range of packages for the Vic and we obtained a wide range, including three in cassette form and five in cartridges.

All the cartridges were Adventure games: Adventureland, Pirate Cove, Mission Impossible, Voodoo Castle and the Count. Each one gives you full instructions for saving a game, as you are unlikely to finish one the first time.

More important, you are given details of mapping — a logical approach to checking your progress by producing a flow chart. Mapping saves time and lets you complete a game in a shorter amount of time.



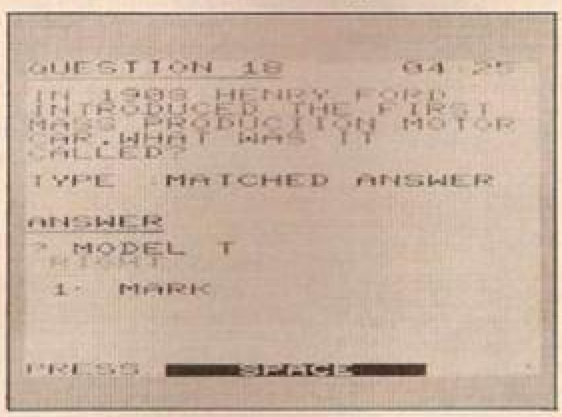
Commodore Mastermind is almost the same as the program, without Magnus Magnusson. Especially as extra cassettes are available for other specialised subjects. We were supplied with General Knowledge 4 and three specialised subjects: Sport and Games; Film and TV; Wine, Food and Music. Up to four people can play.

You first load the operating tape and start. You are asked how many players are involved, and their names and occupations — just like on TV. When they state their specialised subject, you must load the appropriate tape. After this part you repeat the process for each contestant.

The game comes complete with two cassettes, one for the operating system and the second for general knowledge questions. So if you want to play with four people, it is best to buy the extra specialised subjects cassettes which are only £1.99 each. An ideal family Christmas present.

Vic Quizmaster lets you create your own quizzes for teaching or your own entertainment. It comes complete with a data cassette demonstration and gives you a number of choices. A question with matched answer, true/false, multiple choice or if you want to create your own type of quiz just enter the last option. By creating your own quizzes this program could let you produce your own versions of Mastermind. Very good value.

English Language for the Vic, is squarely aimed at people who are facing GCE O-Level and CSE examinations. It does its job well. There is a choice of composition, spelling, grammar, general, summary and comprehension. Further options available are a timed test, questions and answers, or answers left until the end. You are supplied with two



cassettes, the program and a data cassette. When you need to rewind the data cassette an instruction appears on the screen.

ASK stands for Applied Systems Knowledge, and this company produces a range of six tapes for learning and fun at home. Each one needs a 16K RAM pack and the loading time is clearly stated on each cassette.

Facemaker is an interactive program with three levels of difficulty. It is intended to improve spelling and vocabulary, plus sharpening up observation. You actually draw the faces on the screen and the graphics are of an extremely high standard. Intended for 5-12 year olds, we showed it to some 10 and 12 year olds and they found it fun; they learnt too.

Number Chaser, as the name implies, improves skills that could have lapsed through the use of calculators — and micros. There are four levels. This one was also liked by the 10 and 12 year olds.

We Want to Count is aimed at the youngest audience — three-year-olds upwards and has excellent graphics with a four-part program that the children can use on their own.

Twister is a problem-solving program where a geometric puzzle must be rearranged so that no column or row contains a repeated colour. You can have from three to 10 columns and if you get stuck, there is a help facility. Once you have mastered Twister, then you can try Super Twister on the same tape.

Last of the six programs from ASK, Rainbow Towers, is a game concerning six towers, three of them with discs to be moved to the other ones. The discs are of different sizes and as they move the colours change. You must end up with each tower having a disc of a single colour arranged in a specific order.

It can be considered to be another version of the classic Towers of Hanoi, a puzzle which appears very simple in theory, but not in practice. Designed for eight-year-olds upwards; however, this game is one which would appeal to older people too.

(continued on page 33)

(continued from page 31)

Llamasoft provided just the one game — Gridrunner — in cassette form. The lowest-priced of all the software in this feature, Gridrunner is one of the most interesting games, being a version of Caterpillar with a red grid. You have to try to chop the caterpillar into tiny pieces until it is destroyed. A very fast game and really effective use of graphics.

Postern Software provided two games in cassette form, Siege and Shadowfax. Siege is another popular game available in similar versions on other brands of micro. The idea is to try to stop the hordes of infidels climbing up the wall of your stronghold and taking over. In this version you throw blue objects down at the increasing numbers of infidels and when you think you are winning, they increase and move faster. A good value game.

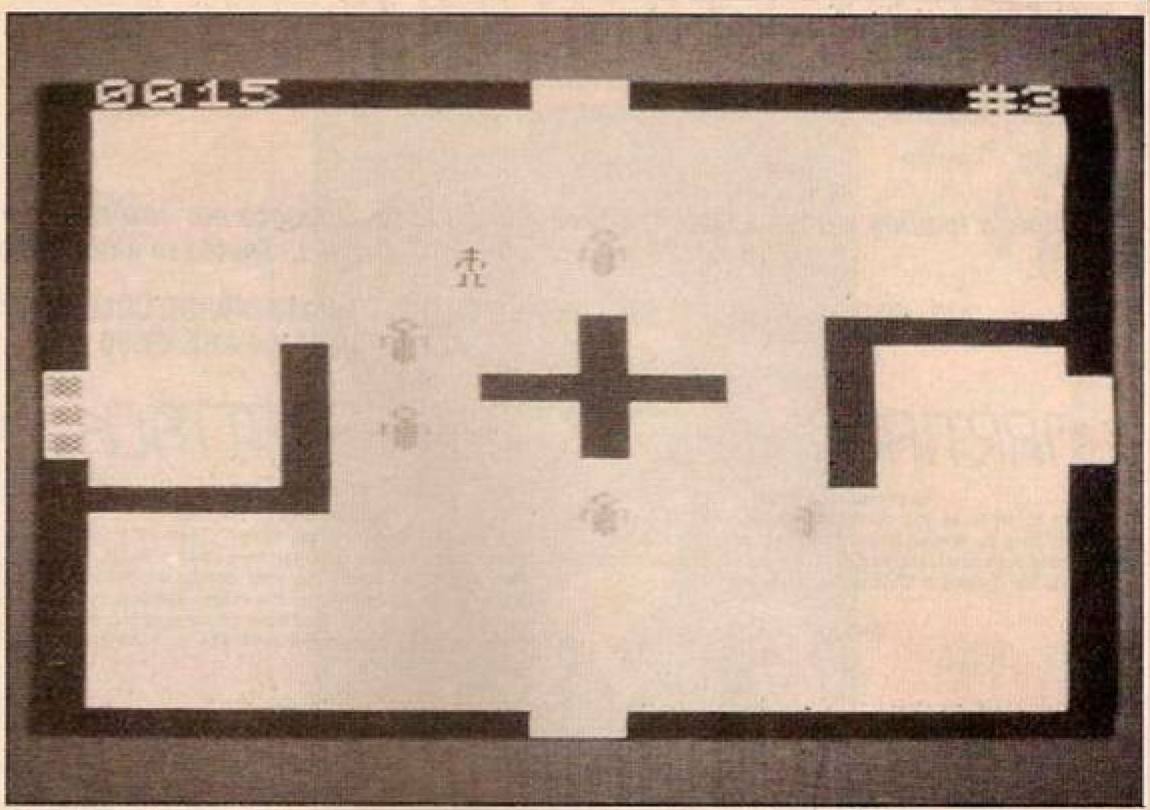
The second game from Postern, Shadowfax, is completely different from any of the games in this feature. You have two sets of horses and riders — one white, the other black — riding towards each other on a green background. A nice change from the versions of Space Invaders and Galaxians.

Rabbit Software of Harrow supplied five games on cassette and one of them stood out as being far better than most of the other games reviewed. Called Myriad, it needs an extra 3K and is one of the fastest-operating space games available. While lots of games have four, six or even ten levels, Myriad has almost 200 and a fantastic range of hazards — from ordinary bricks dropped by a builder to lethal bombs.

You can be attacked by a virus, but it takes three attacks to kill you. Dangerous reflectors send your beam back towards you, so you can wipe yourself out by mistake. On your side are shields, which last for just four and a half seconds and you get three of them for every 10,000 points — a compulsive keyboard or joystick-operated game.

Space Phreeks from Rabbit has 15 different phases before it repeats. You need to shoot down different types of alien and as you progress through the phases it becomes far more difficult.

Rabbit's Nightcrawler is a game like Centipede — a version of the one with the worm. Here you have 39 levels and you have to chop



up this night crawler and destroy it. A version of Pac-Man goes across the screen at the same time to destroy it. This is a very fast game.

Hopper gives you the problem of crossing a busy motorway, then over a river full of logs running along it. You must dodge through the traffic, avoid being knocked down, then use the logs to cross the river. Another fast game.

Rabbit's Space Storm is really intended for young children. You are in space and must destroy the incoming aliens. You are given a long range view to see what will be coming towards you and if you are hit, a damage report in percentage terms is shown at the bottom of the screen. As you destroy the aliens the speed rapidly increases and you are given three lives.

Romik Software supplied five programs all designed to be used with the unexpanded Vic. Shark Attack sets you the objective of trapping the sharks before they can cause any damage. You control the net and the entire screen can be filled with nets. Your primary task is to separate each shark into its own space. The simplest way is to produce a lattice framework over the screen. Quite different from any of the other games, but quite simple.

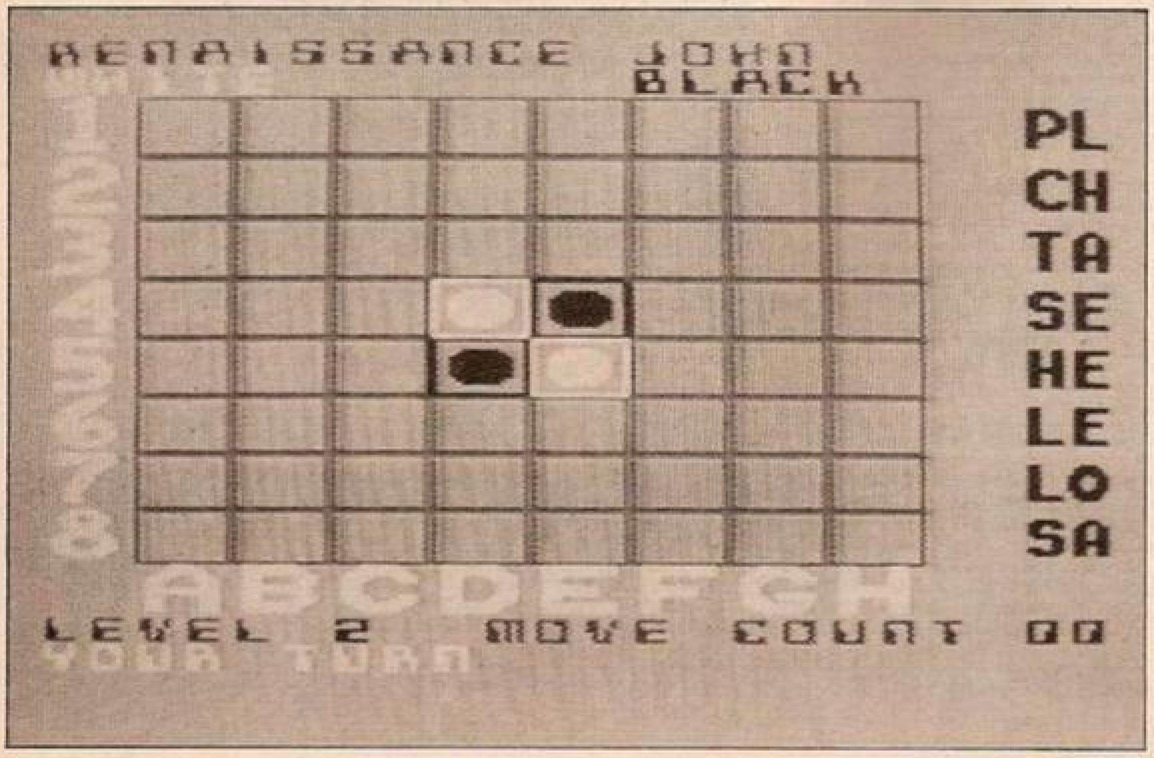
Sea Invasion from Romik frankly looked just like Space Invaders apart from the description on the cover of the cassette. A good example of this type of game, but nothing really different.

Martian Raiders would not load with the tape recorder and Vic I was using, so I gave it to someone else to use on their machine. Still no joy. The screen showed error 17184 plus run out of memory, but I could not see any indication of any extra memory being needed.

Mind Twisters shared the same problem as Martian Raiders. This one was also checked on another Vic, but still no luck.

Out of all the Romik tapes the best one of all must be the Music Synthesiser. Using the controls from Q to * and A to = it is possible to make music very quickly. You will be surprised how fast you can produce music for yourself.

Both Shark Attack and Martian Raiders have "Be Champion of the World" written across the packaging, so you have free entry to an exciting competition. It is a pity two of the programs would not run; however when lots of tapes are being copied you can find the odd ones that just do not copy properly. ■



CONCLUSIONS

- Owners of the Commodore Vic-20 have one of the most popular micros in this country. Out of literally hundreds of games available we have looked at a cross-section of 39 — these span the range from Space Invaders derivatives to the thinking man's Adventure games, not forgetting the educational packages.
- Cassettes have the edge in price over cartridges: discs are almost as cheap, but it may be wise to see if the prices of disc drives fall radically as the market alters.
- Price is no indication of quality: cassettes costing £5 stood up very well against far more expensive programs.
- Beware of super graphics on the packaging, it is rare for them to look the same on the screen of your Vic.

SØFTEK



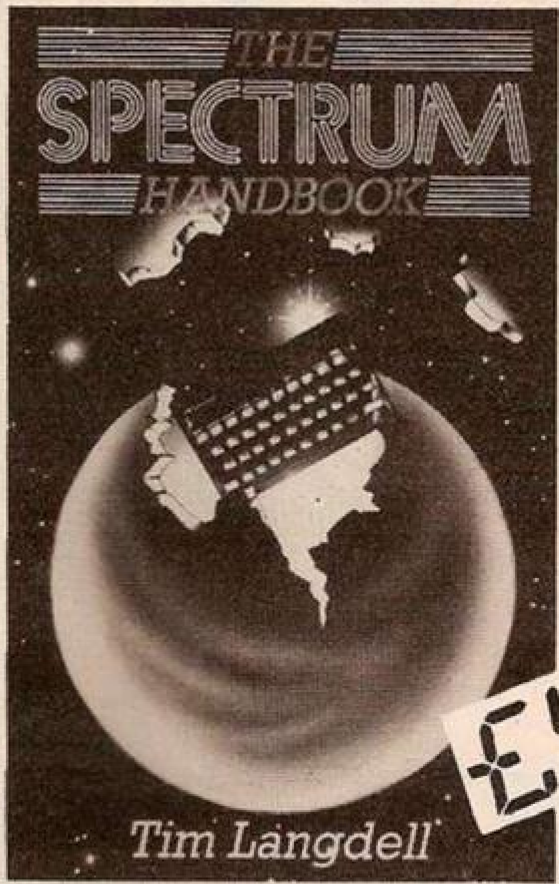
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METEOROIDS

Many hundreds of buyers have acclaimed this the fastest and smoothest version of the popular arcade game for the Spectrum — the only version with full colour, three meteoroid sizes, hyperspace, thrust, sheild, mothership, freeze-frame, high score, bonus ship at 10,000, etc. Even if you have another version, this one is a must for your collection. With machine code synthesised sound effects which left other software houses wondering how we did it, this has to be the best value around for only £4.95 (for 16K or 48K Spectrums) STOP PRESS: NOW WORKS WITH KEMPSTON ELECTRONICS' JOYSTICK! Available from us for only £19.50 inc.

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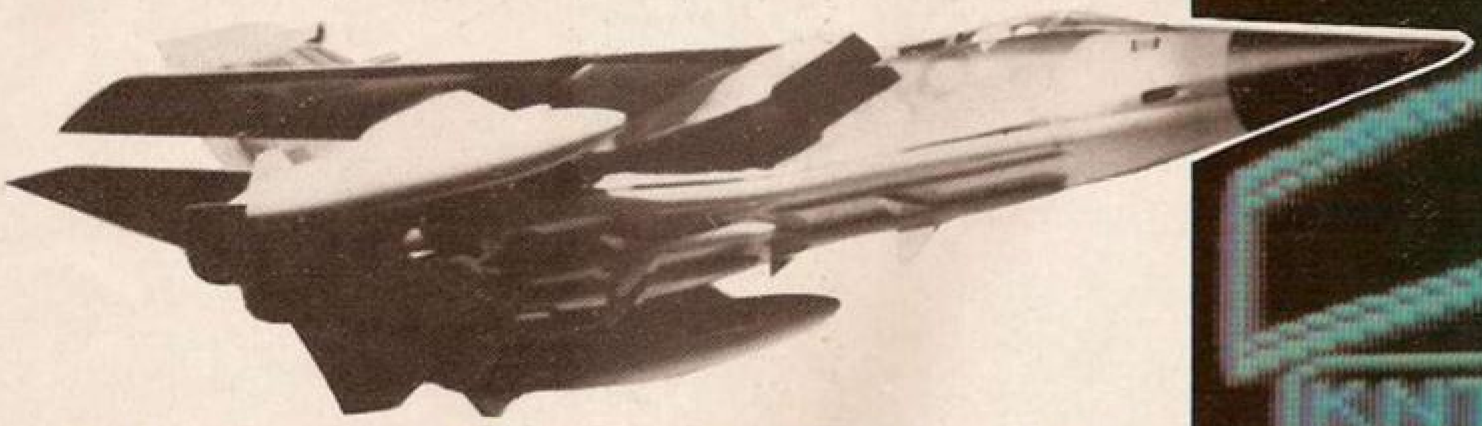
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ZX SPECTRUM FL

THIS FLIGHT simulator is a fairly elaborate program leaving little memory to spare in a 16K Spectrum. In consequence, a methodical approach to some resolute typing is demanded of the would-be pilot.

Firstly, type in the main program, listed in figure 1, Saving it in auto-run mode:

```
SAVE "BA 111"LINE 1
```

Having verified the recording, turn to the machine-code dump in figure 2. Enter this code by way of a short routine such as the following:

```
9990 FOR N=1 TO 236:PRINT 23295+n,:INPUT
     "Enter byte",i:POKE 23295+n,i:
     PRINT i:NEXT n
```

This procedure allows checking of each byte as entered. Once complete, the code should be saved immediately following the main program on tape:

```
SAVE " "CODE 23296,236
```

Again, verify the recording. Leave the tape set at the end of the code and type in the screen-plotting routine listed in figure 3.

Now type Run, switch the recorder to record, press Enter, and the display will be saved. In future, the screen will be loaded directly from tape by the main program; but to be on the safe side, save the plotting routine elsewhere.

Next, a little guidance on using the program. In the first place, do not expect flying an aircraft to be too easy. Figure 4 enumerates the controls used — familiarise yourself with them before running. Note that the method of keyboard decoding used means that a single, brief key-press will be read. Notice also that some controls operate as on/off switches.

Shortage of RAM precludes any attempt at making the program completely bombproof, though most of the silly possibilities which delight bug-hunters have been foreseen. For example, the undercarriage cannot be raised on the ground, and the brakes will not work in the air! Figure 5 gives a concise chart of the area around Edinburgh Airport, the arena of the simulation, showing beacons and two runways. This chart is available on a CRT monitor in the cockpit during run time. Navigation is by means of the beacons, which provide two types of information. First, radial: this is your bearing from the beacon in use; and secondly, DME: distance from the beacon — Distance Measuring Equipment.

Beacons EDN and UWB must be used to approach the runways. Radial and DME are displayed on the central panel of the cockpit, to the right of which a head-up display indicates the direction of the beacon by a flashing cursor in relation to the plane's heading.

The CRT monitor mentioned serves three purposes: it defaults to an artificial horizon display, the plane being viewed from the rear over a horizon which swings in proportion to roll, attitude, lift. Secondly, map: this gives beacon positions, and that of the plane if within the boundaries of the display — a dot within a flashing square. The latter is not updated while the map is accessed. Third, a view of the runway while landing.

Some final points about the cockpit. Warning lights are provided for brakes on, gear up when landing, emergency fuel, plane descending — Rate of Climb becomes Rate of Descent — and plane approaching out-of-control condition.

In connection with the last mentioned, remember to increase power/speed/flap, to

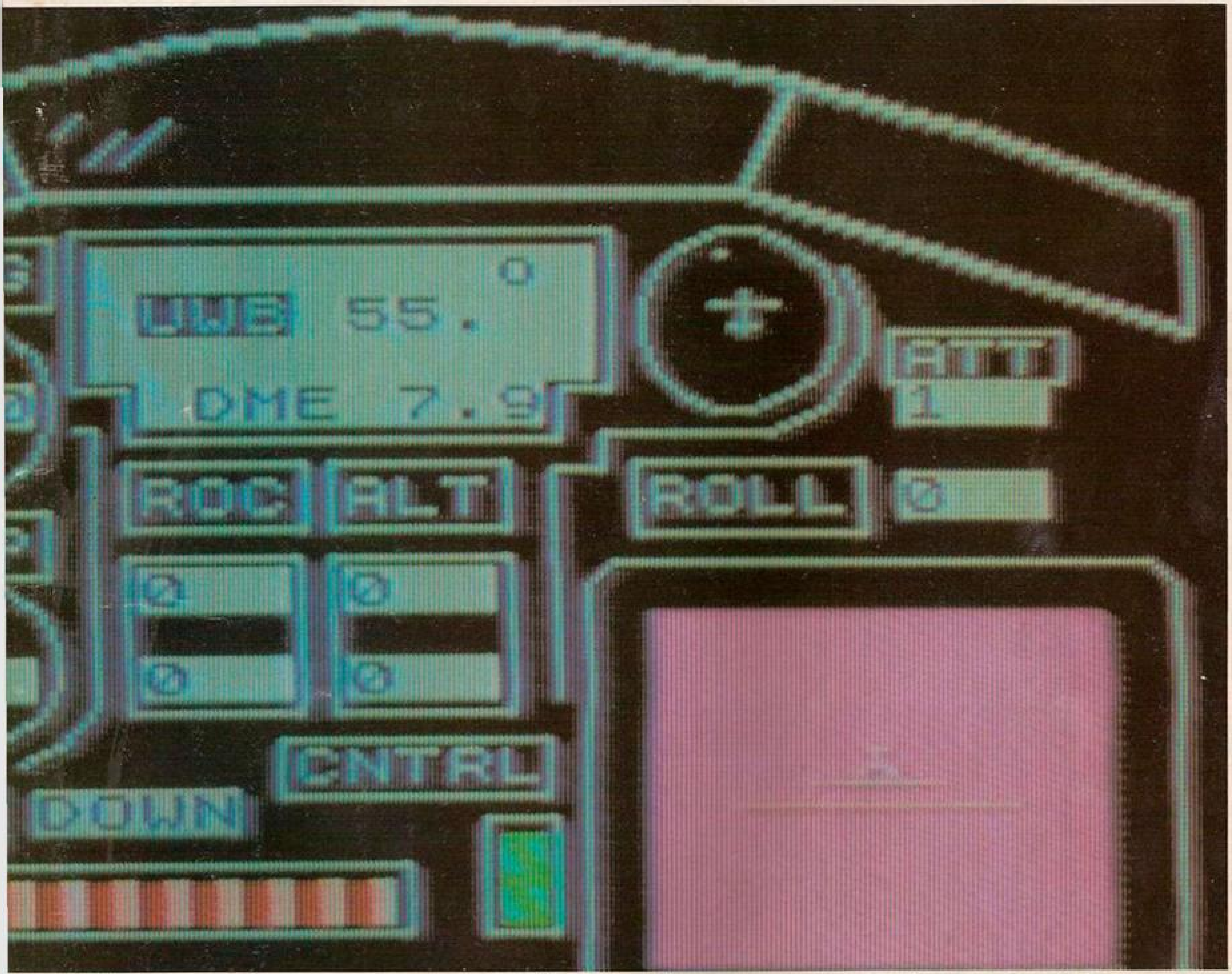
(continued on page 41)

Figure 6. Program breakdown.

From	To	Function
5	240	Main flying loop
2000	2070	Flap
2100	2108	Power
2110	2116	Roll
2120	2129	Attitude
2500	2515	Gear
2520	2546	Map
2580	2595	Update variables
8500	8810	Landing routine
9000	9020	Brakes
9500	9502	Head-up
9510	9511	Beacon
9520	9522	Out of control
9530	9545	Artificial horizon
9550	9560	Take-off set-up
9640	9644	Fuel
9650	9665	Initialising subroutine
9680	9682	Exit/messages
USR	23296	Clear monitor during landing
USR	23391	Update instruments
USR	23483	Print plane

Figure 4. Keyboard decoding.

Keypress	Function
B	Brakes on/off
C	Change beacon
D/U	Down/up
R/L	Right/left
J(−)/K(+)	Less/more flap
P	Power increase, stop decrease
O	Power decrease, stop increase
M	Map on/off
G	Gear up/down



IGHT SIMULATOR

Figure 3. Screen construction.

```
  1  REM BA 111  SCREEN$
  5  BORDER 0: PAPER 0: INK 5: CLS
 10  PLOT 0,120: DRAW 70,25: DRAW 114,0: DRAW 71,-25: DRAW 0,23: DRAW -
   127,32,.3: DRAW -128,-32,.3: DRAW 0,-23: PLOT 2,125: DRAW 0,16: DRAW
    58,19,-.2: DRAW 8,-13: DRAW -66,-24
 12  PLOT 70,145: DRAW -10,18: PLOT 184,145: DRAW 10,18: PLOT 80,150: D
   RAW 6,6: PLOT 84,150: DRAW 5,5: PLOT 75,155: DRAW 3,3
 14  FOR n=5 TO 7: PRINT  AT n,10: INVERSE 1;"            ": NEXT n: PRIN
   T  TAB 11: INVERSE 1;"          "
 16  CIRCLE 20,60,16: CIRCLE 15,102,16: CIRCLE 59,62,16: CIRCLE 58,107,
   16: CIRCLE 182,122,16
 17  DATA 14,1,9,1,8,6,14,6,12,11,14,11,10,26,8,26,12,15,14,15
 20  RESTORE 17: FOR n=1 TO 10: READ a,b: PRINT  AT a,b; INVERSE 1;"
   ": NEXT n
 22  DATA "0",18,18,"0",18,16,"GAS",20,4,"                ",19,4,"BR",18,1,
   "PWR",12,1,"KNT",7,1,"HDG",6,6,"FLP",12,6,"GEAR",17,4,"ROC",10,11,"R
   OLL",10,21,"ATT",7,26,"BCN",6,11,"CNTRL",17,14,"ALT",10,15
 24  FOR N=1 TO 14: READ A$,A,B: PRINT  AT A,B;A$: LET X= LEN A$*8+4: P
   LOT (B-1)*8+6,(22-A)*8+1: DRAW X,0: DRAW 0,-10: DRAW -X,0: DRAW 0,10
   : NEXT N
 26  PLOT 85,81: GO SUB 100: PLOT 116,81: GO SUB 100
 28  PLOT 158,4: DRAW 4,-4: DRAW 84,0: DRAW 4,4: DRAW 0,72: DRAW -4,4:
   DRAW -84,0: DRAW -4,-4: DRAW 0,-72: FOR N=13 TO 20: PRINT  AT N,21;
   PAPER 3;"           ": NEXT N
 30  PRINT  INVERSE 1; AT 8,12;"DME"; AT 5,18;"o"; AT 17,9;"     "
 32  PLOT 86,101: DRAW 67,0: DRAW 0,8: DRAW 9,0: DRAW 0,30: DRAW -84,0:
    DRAW 0,-30: DRAW 8,0: DRAW 0,-8
 36  DATA 1,1,255,1,1,1,7,1,0,0,254,0,0,0,192,0
 38  RESTORE 36: FOR N=0 TO 7: READ A: POKE  USR "K"+N,A: NEXT N: FOR N
   =0 TO 7: READ A: POKE  USR "L"+N,A: NEXT N: PRINT  AT 6,22;"KL"
 40  PLOT 78,103: DRAW 3,0: DRAW 0,-42: DRAW -14,-17,-1.2: PLOT 200,130
   : DRAW -18,-29,-1.95: DRAW -24,0: DRAW 0,-8: DRAW -6,0: DRAW 0,-44
 99  SAVE "BA111 SCREEN$ ": STOP
100  DRAW 29,0: DRAW 0,-28: DRAW -29,0: DRAW 0,28: RETURN
```

Figure 2. Machine code dump.

23296	175	33	129	92	54	1	33	20	79	6
23306	7	197	229	6	8	14	11	36	229	119
23316	35	13	32	251	225	16	244	225	17	32
23326	0	25	193	16	232	33	129	92	190	200
23336	119	6	3	33	180	71	24	219	32	33
23346	34	193	72	32	10	207	64	18	18	33
23356	72	32	15	139	72	22	12	203	72	22
23366	10	6	72	27	16	90	72	7	14	198
23376	72	27	10	143	72	18	12	207	72	18
23386	10	16	72	17	16	62	12	50	145	92
23396	6	11	42	75	92	17	8	0	25	221
23406	33	51	91	197	229	33	131	92	6	2
23416	221	126	0	221	35	35	119	221	126	0
23426	221	35	35	119	35	35	16	238	225	6
23436	3	126	221	229	229	197	215	193	225	221
23446	225	35	16	243	193	16	212	175	50	145
23456	92	201	0	0	0	0	0	0	0	1
23466	255	16	124	16	16	124	198	69	255	0
23476	0	0	0	0	0	0	254	0	253	202
23486	2	134	33	163	90	34	54	92	33	24
23496	80	34	132	92	33	9	8	34	136	92
23506	1	3	0	17	48	91	205	60	32	33
23516	24	90	6	3	54	31	35	16	251	33
23526	0	60	34	54	92	201	0	0	0	0

(continued from page 38)

increase lift. Both ROC and ALT meters show thousands of feet in the top window, feet in the lower.

Take-off will not be achieved at speeds less than 100 knots, or with an altitude less than 10. For Landing, bearings are given on the chart. Try to approach on a glide path — insurance against engine trouble — losing height at around 6-800 feet a minute. The CRT will not indicate permission to land, that is when the runway is shown, unless your angular approach is viable ±10° of ideal. Once committed to landing, the attempt must be seen through. To practise landing, define your location at the prompts with:

Beacon?="EDN" ; Radial?= 70 ; Heading?= 250 ; DME?= 2. Increase flap angle to maintain lift as speed falls, and do not forget to brake fairly quickly after touchdown, when the altimeter shows 10 feet, as the runway is not indefinitely long.

Figure 6 gives a breakdown of the components of the program.

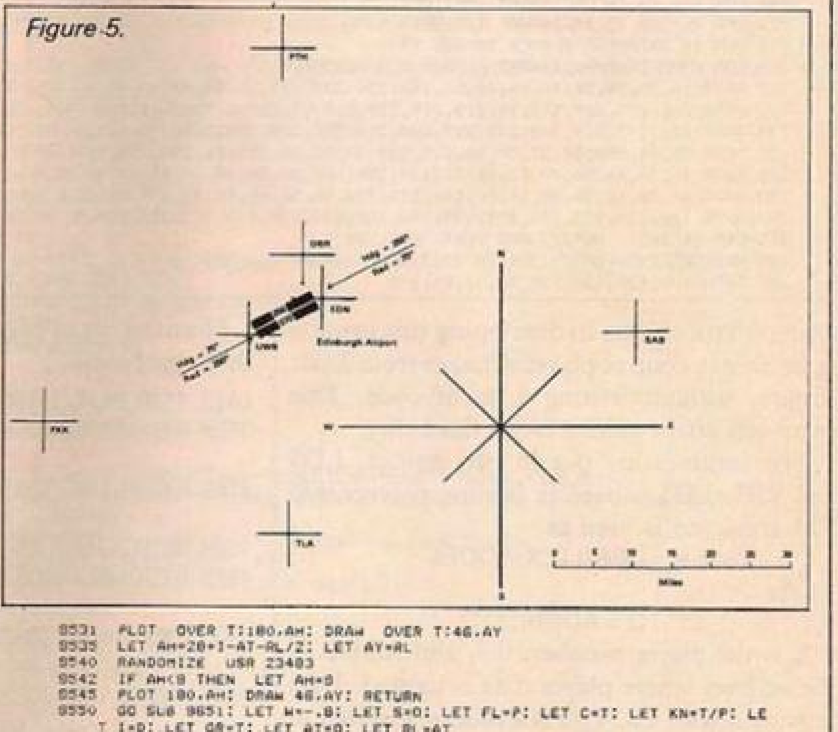
For the interested who do not have the stamina or the time to type in the simulator themselves, a cassette of the complete program is available for £3 from the author, Rod Hopkins, at 116 Pilmuir Street, Dunfermline, Fife, Scotland. ■

Figure 1. The main program.

```
   5 LOAD "" CODE : BORDER 0: PAPER 0: INK 7: CLEAR : LOAD "" SCREEN$ :
     DIM S$(11,3): GO SUB 9650
   6 INPUT "TAKE-OFF? (Y/N)  ";a$: IF a$="Y" THEN  GO TO 9550
   8 INPUT "OK...STARTING ALTITUDE?  ";AL: LET AL=AL*P: INPUT "WIND DIR
    ECTION? ";WD: LET WD=WD*RAD: INPUT "WINDSPEED? ";WS: LET WS=WS/2E3:
    INPUT "DEFINE LOCATION?(Y/N)";X$: IF X$ <> "Y" THEN  GO TO D*P
  25 INPUT "BEACON? ";x$: FOR G=T TO 7: IF x$=M$(G) THEN  GO TO 28
  26 NEXT G: GO TO 25
  28 LET B=G-T: LET B=B+7*(B=0): GO SUB 9510: INPUT "RADIAL?  ";RD: LET
     RD=RD*RAD
  30 INPUT "HEADING?  ";HD: LET HD=HD*RAD: INPUT "DME?  ";DM: LET S=DM*
     COS RD: LET W=DM* SIN RD
  40 LET S=S+SF* COS HD+WS* COS WD: LET W=W+SF* SIN HD+WS* SIN WD: LET
    DM= SQR (S*S+W*W): LET RD= ACS (S/DM): IF W<0 THEN  LET RD=Y* PI -RD
  50 LET HD=HD+RL/(SF*1.5E4): IF HD*DEG>360 THEN  LET HD=HD-Y* PI
  55 IF HD<0 THEN  LET HD=HD+Y* PI
  60 IF C AND DM<6 THEN  LET B=T: GO TO EX
  65 LET G=G-(PR+20)/M1: IF G<500 THEN  GO SUB 9644-M1
  70 LET G$=A$( TO G/1E3)
  80 IF C THEN  LET AL=0: LET RC=0: LET E=PR: LET KN=KN+E: GO TO 105
  90 LET I=2E4/KN: IF J <> I AND  NOT M THEN  GO SUB 9530: LET J=I
 102 LET RC=AT*KN/60-ST*20: LET E=PR-(FL*KN/4E3)-(GR*KN/400)-RC/P: LET
   KN=KN+E*2E3/KN*(KN<4E3 OR SGN E=-1): IF KN<(1.5E3-FL*P) THEN  GO SUB
   9520: GO TO 108
 103 LET ST=0: POKE 23054,7: GO TO 108
 105 IF AT>0 THEN  LET C=0: GO TO 102
 111 LET SF=KN/25E3: PRINT  AT 19,0; PAPER Y;G$: LET A1=0: LET AL=AL+RC
   *3/Y: LET FS=KN/2E4: GO SUB 2580
 146 RANDOMIZE  USR 23391: GO SUB 9500: IF TH THEN  GO SUB 2095+TH*5
 200 IF  PEEK 23560<65 THEN  GO TO 216
 210 LET SI= PEEK 23560-64: IF SI>0 AND SI<22 THEN  GO SUB S(SI)
 215 POKE 23560,0
 216 IF C THEN  GO TO 40
 228 IF AL<5 THEN  LET B=Y: GO TO EX
 230 IF B>Y OR  ABS S>.4 OR  ABS W>.4 THEN  GO TO 40
 236 IF B=T AND (HD<4.19 OR HD>4.54) THEN  GO TO 40
 238 IF B=Y AND (HD<1.05 OR HD>1.4) THEN  GO TO 40
 240 GO TO 8500
2000 IF FL<30 THEN  LET FL=FL+5
2005 GO TO 2015
2010 IF FL>0 THEN  LET FL=FL-5
2015 LET S$(8)= STR$ FL: RETURN
2070 RETURN
2100 IF TH=Y THEN  LET TH=0: RETURN
2102 IF PR<42 THEN  LET PR=PR+D: LET TH=T: RETURN
2105 IF TH=T THEN  LET TH=0: RETURN
2107 IF PR>-20 THEN  LET PR=PR-D: LET TH=Y: RETURN
2108 RETURN
2110 IF LA THEN  LET C=C+Y: GO TO 2117
2111 IF  NOT C THEN  LET RL=RL+P*(RL<60)
2112 GO TO 2116
2113 IF LA THEN  LET C=C-Y: GO TO 2117
2115 IF  NOT C THEN  LET RL=RL-P*(RL>-60)
2116 GO SUB 9530: RETURN
2117 LET HD=HD+C/65
2120 IF C=T OR AT<-D THEN  RETURN
2122 LET AT=AT-T: GO TO 2127
2125 IF (KN<1E3 AND  NOT LA) OR AT>10 THEN  RETURN
2126 LET AT=AT+T
2127 PRINT  AT 8,26; INVERSE T;AT+T;" ": IF M OR LA THEN  RETURN
2129 GO SUB 9530: RETURN
2500 IF GR AND  NOT C THEN  PRINT  AT 17,P-T; INVERSE T;"UP  ": LET GR=
   0: RETURN
2510 IF  NOT GR AND ( NOT C OR M=400) THEN  PRINT  AT 17,9; INVERSE T;"
   DOWN": POKE 23076,7: LET GR=T: RETURN
2515 RETURN
2520 IF M THEN  GO TO 2545
2521 LET M=T: POKE 23560,0: RESTORE 9660: FOR q=0 TO 7: PRINT  AT 13+q,
   21; PAPER T;"          ": NEXT q
2525 PRINT  PAPER 1; AT 20,25;"tla"; AT 18,22;"fkk"; AT 16,21;"uws"; AT
    16,25;"edn"; AT 18,27;"sas"; AT 13,25;"pth"; AT 15,23;"dbr"
2530 LET Q1=198: LET Q2=40
2535 FOR q=0 TO 6: PLOT Q1,Q2
2537 IF B-T=Q THEN  LET p1=q1: LET p2=q2: LET p1=p1+W/1.2: LET p2=p2+S/
   1.2: IF P1<256 AND P2<78 AND P2>-T AND P1>160 THEN  PLOT  FLASH T;p1
   ,p2: LET P3=T
2540 READ M$(Q+T),J,I: LET Q1=Q1-I/1.2: LET Q2=Q2-J/1.2: NEXT q: RETURN

2545 IF P3=T THEN  LET P3=0: PLOT  OVER T; FLASH 0;P1,P2
2546 LET M=0: FOR q=0 TO 7: PRINT  AT 13+Q,21; PAPER 3; FLASH 0;"
     ": NEXT q: GO TO 8535
2580 LET AL=AL/P: LET AL1= INT (AL/1E3)+T*( SGN AL=-T): LET S$(6)= STR$
    AL1: LET AL1= INT (AL-AL1*1E3): LET S$(P)= STR$ AL1: LET AL=AL*P
2583 LET S$(3)= STR$ (KN/P)
2584 LET S$(Y)= STR$ (DEG*RD)
2585 LET S$(6)= STR$ (DEG*HD)
2586 LET S$(7)= STR$ RL
2587 LET S$(11)= STR$ DM
2588 LET S$(T)= STR$ (PR+110)
2590 LET S$(D)= STR$ ( INT (RC/100)+T*( SGN RC=-T)): LET S$(5)= STR$ (
   INT (P*RC- VAL S$(D)*1E3))
2592 IF  SGN RC=-T THEN  LET S$(5)=S$(5,Y TO 3)+"0": PRINT  FLASH T; AT
    P,13;"D": FLASH 0: RETURN
2594 PRINT  AT P,13;"C"
2595 RETURN
8500 LET G=-T: PRINT  AT P,15;"HOT": LET S$(D)="   ": LET S$(5)="   ":
   LET LA=T: LET E1=E
8505 LET S(Y)=8E3: LET S(3)=2070
8560 LET n=P*P: LET s=-N: LET e=22E3: LET w=13E3: LET a=50: LET AL=AL/F
   - RND *A
8570 LET C=(HD*DEG-250+180*(B=Y))*5
8610 LET Z=0: LET x=204: LET k=35: LET J=D*P: LET M=J*P: FOR G=0 TO 7:
   PRINT  AT 13+G,21;"          ": NEXT G: IF  NOT GR THEN  POKE 23076,1
   84
8640 LET F=KN/35*A: LET E=E-F: LET W=W-F: LET s=s-c/P: LET n=s*200: IF
   AL>8 THEN  LET AL=AL+D*AT: GO TO 8645
8643 LET AL=0: PRINT  AT P,13;"C": LET S$(D)="   ": LET S$(5)="   "
8645 IF KN<100 THEN  LET KN=0
8650 LET R=M*n/W-c*x: LET L=M*s/w-c*x: LET v=M*n/e-c*x: LET i=M*s/e-c*x
   : LET U=-M*AL/W-Y*AT*K: LET T1=-M*AL/E-Y*AT*K
8665 IF  ABS (R-X)>J THEN  LET R= SGN R*J+X
8670 IF  ABS (V-X)>J THEN  LET V= SGN V*J+X
8675 IF L<X-J THEN  LET L=X-J
8676 IF L>X+J THEN  LET L=X+J
8680 IF  ABS (I-X)>J THEN  LET I= SGN I*J+X
8685 IF  ABS (T1-K)>K THEN  LET T1= SGN T1*K+K
8690 IF  ABS (U-K)>K THEN  LET U= SGN U*K+K
8695 IF U >= 35 AND W<M THEN  LET U=3: LET T1=35
8710 RANDOMIZE  USR 23296: PLOT 158,D: DRAW D,-D: DRAW 88,0: DRAW D,D
8715 PLOT R,U: DRAW L-R,0: PLOT L,U: DRAW I-L,T1-U: PLOT I,T1: DRAW V-I
   ,0: PLOT V,T1: DRAW R-V,U-T1
8721 IF E1>2E3 THEN  GO TO 8723
8722 IF  NOT AL AND C<Y THEN  PRINT  AT 16,21;"[graphics]" (nine characters)
8724 IF  NOT AL THEN  LET RC=AL: GO TO 8730
8725 LET RC=Y*AT*KN/120: LET E1=PR-FL*KN/4E3-GR*KN/300-RC/P: LET KN=KN+
    E1*2E3/KN
8730 IF AL>0 THEN  LET AL=AL*P: GO SUB 2580: LET AL=AL/P: GO TO 8734
8732 GO SUB 2583
8734 LET S$(Y)="   ": LET S$(11)="   "
8735 RANDOMIZE  USR 23391
8736 IF G=T THEN  GO SUB 9010
8737 IF TH THEN  GO SUB 2095+TH*5
8741 IF AL<20 THEN  GO TO 8750
8742 IF KN<(1.5E3-FL*P) THEN  GO SUB 9520: GO TO 8747
8745 POKE 23054,7: LET ST=0
8750 IF  PEEK 23560<65 THEN  GO TO 8780
8760 LET SI= PEEK 23560-64: IF SI>0 AND SI<22 THEN  GO SUB S(SI)
8770 POKE 23560,0
8780 IF w<X THEN  LET w=X: IF e<2E3 THEN  GO TO 8830
8800 IF AL<20 AND  NOT Z THEN  GO TO 9570
8810 GO TO 8640
8830 IF AL>P OR KN THEN  LET B=T: GO TO EX
8840 LET B=D: GO TO EX
9000 LET G=-G: POKE 23105,7+177*(G=T)
9010 IF AL>P THEN  RETURN
9018 IF KN>100 THEN  LET KN=KN-100: RETURN
9020 LET KN=0: RETURN
9500 LET r=RD+ PI : LET a1=HD-r: PLOT  OVER T;x3,y1: DRAW  OVER T;T,0
9502 LET x3=182-12* SIN a1: LET y1=122+12* COS a1: PLOT X3,Y1: DRAW T,0
   : RETURN
9510 LET S=S+A(B): LET w=w+B(B): LET B=B+T: IF B=8 THEN  LET B=T
9511 PRINT  AT 5,11;M$(B): RETURN
9520 IF C OR AL<50 THEN  RETURN
9521 LET ST=ST+T: POKE 23054,184: IF ST<20 THEN  RETURN
9522 LET B=D+T: GO TO EX
9525 DATA "OUT OF RNWY..","NOSE DIVE..","","NICE WORK CAP'N!","OUT OF C
    ONTROL..","IMPACT BEFORE RNWY","CRASH R OF RNWY","IMPACT L OF RNWY",
    "UNDERCARRIAGE?","LANDING TOO STEEP","OUT OF FUEL.."
9530 IF M THEN  RETURN
```

Figure 5.




```
9531 PLOT  OVER T;180,AH: DRAW  OVER T;46,AY
9535 LET AH=28+I-AT-RL/2: LET AY=RL
9540 RANDOMIZE  USR 23483
9542 IF AH<8 THEN  LET AH=8
9545 PLOT 180,AH: DRAW 46,AY: RETURN
9550 GO SUB 9651: LET W=-.8: LET S=0: LET FL=P: LET C=T: LET KN=T/P: LE
   T I=0: LET GR=T: LET AT=0: LET RL=AT
9551 PRINT  AT 17,P-T; INVERSE T;"DOWN"
9552 LET PR=0: PRINT  INVERSE T; AT 14,T;"   "
9553 LET WS=0: LET WD=0: LET B=T: GO SUB S(3)
9554 LET HD=250*RAD: LET SF=1E-10
9560 GO TO D*P
9570 IF E>9E3 THEN  LET B=D+Y: GO TO EX
9575 IF N<20 THEN  LET B=7: GO TO EX
9580 IF N>180 THEN  LET B=D+D: GO TO EX
9585 IF  NOT GR THEN  LET B=9: GO TO EX
9590 IF AT<-3 THEN  LET B=P: GO TO EX
9625 LET Z=T: LET A=120: GO TO 8640
9640 LET G=12400: LET M1=Y: PRINT  AT 21,D; FLASH T;"F": RETURN
9644 LET B=P+T: GO TO EX
9650 LET P=10: DIM G$(12): LET EX=9680: LET C=0: LET D=C: LET RT=C: LET
    P3=C
9651 LET LA=0: LET FL=0: LET TH=0: LET M=0: LET ST=0: LET X3=0: LET Y1=
   0: LET RC=0: LET PR=0: LET RL=0: LET AT=0: LET D=4: LET E=1: LET Y=E
   +E: LET J=Y*D: LET I=J: LET M1=0: LET GR=E: LET DEG=180/ PI : LET RA
   D=1/DEG: LET G=12480: LET A$="": POKE 23658,D+D: LET B=
   INT ( RND *E)+E
9652 LET T=E: LET SF=.05: LET KN=2500: LET S= RND *P: LET W=- RND *P: L
   ET HD=RAD*( RND *360)
9654 RESTORE 9660: DIM A(7): DIM B(7): DIM M$(7,3): FOR G=T TO 7: READ
   M$(G),A(G),B(G): NEXT G
9655 DIM S(21): FOR G=T TO 21: LET S(G)=2070: NEXT G: LET S(3)=9510: LE
   T S(D)=2120: LET S(7)=2500: LET S(P)=2010: LET S(P+T)=2E3: LET S(P+Y
   )=2113: LET S(13)=2520: LET S(15)=2105
9656 LET S(16)=2100: LET S(18)=2110: LET S(21)=2125
9657 FOR G=0 TO D+D: PRINT  AT 13+G,P+P;"           ": NEXT G: PLOT 158
   ,0: DRAW D,-D: DRAW 88,0: DRAW D,D: FOR G=0 TO D+D-T: PRINT  AT 13+G
   ,P+P+T; PAPER Y+T;"          ": NEXT G: PRINT  AT P+P+T,0;"

9660 DATA "EDN",4.5,8.4,"UWS",-.1,-50.2,"SAS",27.6,44.38,"TLA",-63.1,.8
   ,"PTH",48,30.8,"FKK",-22.4,-32.3,"DBR",5.1,-1.9
9661 GO SUB 9535: GO SUB S(3): GO SUB 2500
9662 PRINT  AT 8,26; INVERSE T;"1  ": IF  NOT AT THEN  RETURN
9665 LET AT=0: GO TO 3+Y
9680 RESTORE 9525: FOR G=T TO B: READ X$: NEXT G: PRINT  AT P,15;"ALT";
    AT 21,0; FLASH T;X$: INPUT "ANOTHER GO? ";x$: IF x$="Y" THEN  LET R
   T=T: LET C=0: PLOT  OVER T;X3,Y1: DRAW  OVER T;T,0: POKE 23105,D+D-T
   : POKE 23054,7: POKE 23076,7
9681 IF X$="Y" THEN  LET P3=Y: GO TO 9651
9682 PRINT  AT 21,0; INVERSE T;" ROGER AND OUT  ": STOP
```

```
2 REM ******************
4 REM **    CHICKEN    **
6 REM **  S.O.  12-81  **
8 REM ******************
10 OPEN #1,4,0,"K:":DIM L$(20),S$(20),C$(20)
15 ? "INITIALIZING ..."
20 REM ** PAGE 6 ROUTINES AND DATA **
40 FOR I=1536 TO 1587:READ A:POKE I,A:NEXT I
41 REM ** VERTICAL BLANK ROUTINE **
42 DIM VB$(210):FOR I=1 TO 210:READ A:VB$(I)=CHR$(A):NEXT I
43 REM ** LOAD PLAYER ROUTINE **
45 DIM LD$(73):FOR I=1 TO 73:READ A:LD$(I)=CHR$(A):NEXT I
47 REM ** INSERT ADDRESS OF ROUT. IN PAGE 6 **
48 A=ADR(VB$):B=INT(A/256):POKE 1540,B:POKE 1538,A-256*B
50 DATA 104,160,52,162,6,169,7,76,92,228,104,160,98,162,228,169,7,76,92,228
52 DATA 120,120,120,120,30,57,81,105,15,15,15,15,0,0,0,0,52,53,54,55,2,2,3,4,12,15,15,15,15,11,1
1,11
54 REM ** LINE 56 - CHANGE 24 TO 56 TO SKIP ORTHO. **
55 REM ** LINE 56 - CHANGE 28 TO 34 FOR CONT. MOV. **
56 DATA 72,138,72,152,72,162,0,189,120,2,29,44,6,160,15,24,176,32,201,15,240,28,201,14,208,2,160
,13,201,13
57 DATA 208,2,160,14,201,11,208,2,160,7,201,7,208,2,160,11,192,15,240,6,61,48,6,157,28,6,152,61,
44,6,157,44,6
58 DATA 232,224,4,144,195
60 DATA 162,0,189,32,6,133,203,189,36,6,133,204,189,40,6,133,209,198,209,16,7,232,224,4
65 DATA 144,232,176,91,189,28,6,133,207
70 DATA 70,207,176,26,188,24,6,192,1,240,19,208,1,200,177
75 DATA 203,240,6,136,145,203,200,208,245,136,145,203,222,24,6,70,207,176,29,188,24,6,200,192,25
4,176,21
80 DATA 177,203,208,247,136,177,203,240,6,200,145,203,136,208,245,200,145,203,254,24,6,70,207,17
6,3,222,20
85 DATA 6,70,207,176,3,254,20,6,189,20,6,157,0,208
90 DATA 24,144,154,162,4,189,11,208,240,5,169,0,157,39,6,202,208,243,104,168,104,170,104,76,98,2
28
100 DATA 234,234,234,104,104,104,170,189,32,6,133,186,189,36,6,133,187,104,133,213,104,133,212
110 DATA 189,24,6,133,195,169,0,168,192,255,176,35,196,195,240,5,145,186,200,208,243,162,0,161,2
12,240,11
120 DATA 145,186,230,212,200,192,255,176,11,208,241,169,0,145,186,200,192,255,144,249,96,234,234
150 REM ** CAR COLOR DATA **
160 FOR I=1 TO 20:READ A:C$(I)=CHR$(A):NEXT I
170 DATA 24,60,218,68,90,186,70,150,54,232,74,168,88,154,21,252,200,76,228,28
190 REM ** DEFINE PM AREA - SINGLE LINE RESOL. **
200 A=PEEK(106)-16:POKE 54279,A:PM=256*A
205 REM ** PLAYER MISSILE POINTERS **
210 FOR I=4 TO 7:POKE 1568+I,A+I:NEXT I
212 FOR I=1568 TO 1571:POKE I,0:NEXT I
218 REM ** DATA FOR PLAYER IMAGES **
220 FOR I=PM TO PM+121:READ A:POKE I,A:NEXT I
230 DATA 16,56,16,56,40,16,16,16,146,254,254,124,56,56,40,40,40,40,40,108,0
232 DATA 126,195,219,219,91,219,219,219,219,91,219,219,195,126,0
234 DATA 126,195,219,219,218,219,219,219,219,218,219,219,195,126,0
236 DATA 33,34,150,84,57,30,60,123,159,30,52,86,151,36,194,193,0
238 DATA 16,56,16,56,40,16,16,56,124,254,186,56,56,40,40,40,44,32,96,0
240 DATA 16,56,16,56,40,16,16,146,214,124,56,56,40,40,40,104,8,12,0
242 DATA 126,255,173,173,239,199,199,199,199,239,173,173,255,126,0
270 REM ** INIT. HORIZ. AND VERT. POS. **
280 RESTORE 282:FOR I=1556 TO 1563:READ A:POKE I,A:NEXT I
282 DATA 120,120,120,120,30,57,81,105
```

CHIC



GAMES S

ONE OF THE objects in developing this game is to be able to control player missiles from Basic simply, without writing a lot of code. This approach offers quite a bit of flexibility.

The routines are put in two strings, LD$ and VB$. LD$ is used in loading players into PM areas and is used as

A = USR(LD,X,ADDR)

where

LD = ADDR(LD$)

X is the player number, 0-3, and ADDR is the address where player data is located. Data must end with a 0. VB$ is a routine inserted in the vertical blank routine. It is quite complicated and uses a number of locations in page 6. I will try to describe the approach used.

Each joystick is associated with one player. If you do not want to use the joystick to move a certain player, that player can be masked out. Individual directions of movement can also be masked. For example, a player can be made to respond only horizontally or only vertically to a joystick. Orthogonal movement — only vertical or horizontal — is also an option.

The orthogonal movement can be such that a player moves only when the joystick is pushed or the joystick can be used only to change directions of moving objects. Beyond movement by joystick, a continuous movement in a certain direction can be forced with or without joystick control on top of this background movement. Finally, the speed of the object can be controlled by Poking a single byte.

Here is a list of page 6 reserved locations and their purpose:

(ALL FOR PLAYERS 0 TO 3 IN ORDER)

1556 (0614)-1559 (0617)	HORIZONTAL POSITIONS
1560 (0618)-1563 (061B)	VERTICAL POSITIONS
1564 (061C)-1567 (061F)	DIRECTION BYTES
1568 (0620)-1571 (0623)	LOW-BYTE PLAYER AREA POINTER
1572 (0624)-1575 (0627)	HIGH-BYTE PLAYER AREA POINTER
1576 (0628)-1579 (062B)	REPETITIONS (SPEED)
1580 (062C)-1583 (062F)	MASKS FOR JOYSTICKS
1584 (0630)-1587 (0633)	FORCED DIRECTIONS

Direction bytes are like those produced by the joysticks. They could be Poked directly into locations 1564-1567. Values other than 15 give motion in the direction indicated. Position is updated every vertical blank period so at the slowest speed a player will cross the screen in about three seconds. To move faster Poke increasing numbers in the speed bytes. Motion can also be stopped by Poking zero in the speed byte.

Masks are Ored with bytes from the joysticks. Since a 1 bit represents a No for a particular direction, a 15 — hexadecimal 0F — will cut out all directions, that is, eliminate that joystick. Other useful masks are:

12 — ONLY VERTICAL MOTION
3 — ONLY HORIZONTAL MOTION
0 — NO RESTRICTIONS ON MOTION

Directions are also Anded with forced-direction bytes. Zeros represent Yes directions, so a 15 has no effect, and other directions are as those produced by the joystick.

Orthogonal movement cannot be handled by masks alone so a routine is included for this option. Line 54 tells the change necessary to skip this option. Also, when in the orthogonal mode, you can choose continuous motion with the joystick used only to change directions. Line 55 has the change required.

Working with interrupts is tricky. To ensure no conflicts, our VBI routine should be taken out before doing machine language routines other than single Pokes. A routine to do this is located in page 6

A = USR(1546)

A = USR(1536) inserts our VBI routine again. For sake of speed, the load player routine contains these other two routines at the beginning and end. This means loading the player routine automatically inserts our VBI routine.

I found out the hard way that a Load of players has to follow initialisation of PM graphics. In PM, graphics (line 370) has to follow any graphics mode change.

When getting out of the program to Basic, use the Reset key to take out the VBI routine. If you use the break key and do anything else before hitting Reset the system will crash.

Necessary page 6 data — masks, speeds, pointers, etc — could be read in as in lines 45-55 but some of this will depend on size of

KEN RUN

Why did the chicken cross the road? Play this game for the Atari written by Stan Ockers and you will find out. Be among the first to break into Atari Basic games-writing.



SPECIAL

memory and should be initialised separately as in lines 210-212. The pertinent sections — roughly lines 10-290 and 370-390 — can be Listed to cassette and Entered when starting a new program. If no player is required, it is still a good idea to clear the player area with

A=USR(LD,X,ADDR)

where ADDR points to a zero data byte.

Collision routines are meant to be placed at the end of our VBI routine. As it stands only a very simple routine is provided. More complex routines are in the works. The routine provided simply stops both players that collide by setting their speed to zero. Detection of collision — line 510 — and resetting of the collision register and speed bytes is done in Basic.

Enough of this heavy stuff — what about the game?

Why does a chicken cross the road? To score points of course! Just move him with joystick 0, watching out for passing cars. The car speed goes roughly with difficulty — DIF — and DIF will increase each time you get across. DIF will decrease each time you are hit.

You start with 50 points and that score is increased by 10 times the DIF value each time you cross the road. Each time you are hit your score decreases by 20 points. You have about two minutes to start — each count is about four seconds — and 40 seconds will be added for each 300 points you score. Be the first in your clique of Atari gamesters to reach 10,000 chicken points! ■

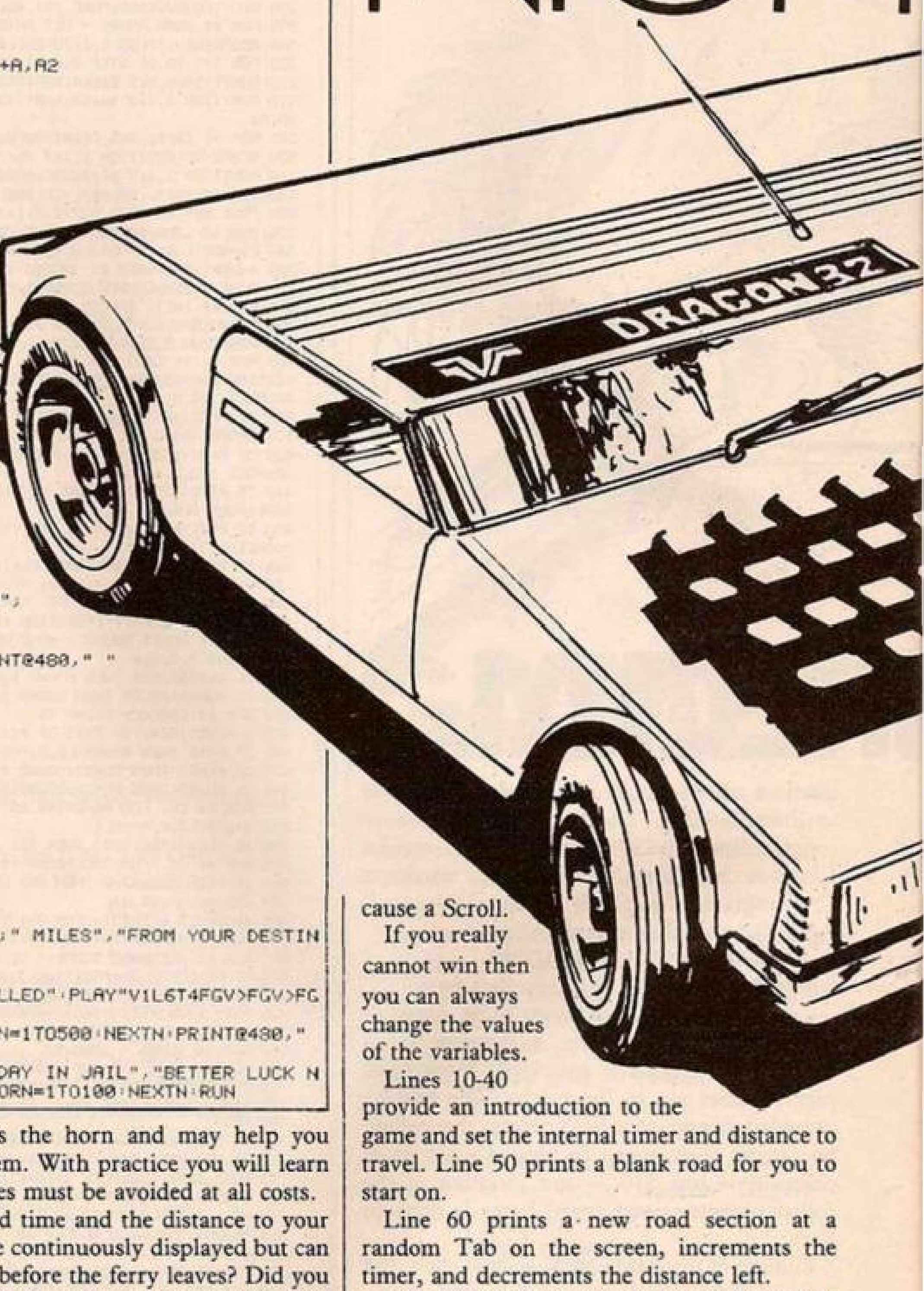
```
288 REM ** INIT COLORS **
290 DIF=3:BONUS=300:POKE 704,40:CP=0:FOR I=1 TO 3:POKE 704+I,ASC(C$(CP+I)):NEXT I:CP=3:BPOS=5
295 REM ** DRAW ROADS - SET PRIORITY **
300 GRAPHICS 17:FOR I=1 TO 20:L$(I)="_":NEXT I
305 FOR I=2 TO 20 STEP 2:S$(I)="-":S$(I-1)=" ":NEXT I
310 POSITION 0,2:? #6;L$:POSITION 0,11:? #6;L$:POSITION 0,13:? #6;L$:POSITION 0,22:? #6;L$
312 POSITION 0,5:? #6;S$:POSITION 0,8:? #6;S$:POSITION 0,16:? #6;S$:POSITION 0,19:? #6;S$:POKE 7
10,90
340 REM ** INIT. AND PRINT INFO. - RESET TIMER **
350 SCORE=50:POSITION 3,1:? #6;"score      time ":POSITION 3,23:? #6;"dif        high ";
360 POSITION 3,0:? #6;SCORE:POSITION 15,22:? #6;HIGH:POKE 77,0:POKE 19,0:POKE 20,0
365 REM ** INIT. PM GR. - FLAGS **
370 POKE 559,62:POKE 53277,3:I1=68:I2=88:FL=I1
375 REM ** LOAD PLAYERS - SET COLORS - PLAYER SIZES **
380 LD=ADR(LD$):A=USR(LD,0,PM):A=USR(LD,1,PM+21):A=USR(LD,2,PM+21):A=USR(LD,3,PM+21)
385 A=USR(1536):REM ** INSERT VBI ROUTINE **
390 POKE 53257,1:POKE 53258,1:POKE 53259,1:POKE 623,1
393 REM ** INIT. SPEEDS **
395 POKE 1576,2:FOR I=1577 TO 1579:POKE I,RND(0)*DIF+1:NEXT I
398 POSITION 4,22:? #6;DIF
400 REM ** IF CARS OFF SCREEN, CHANGE LANES **
410 IF PEEK(1557)<15 AND PEEK(1561)=57 THEN POKE 1561,193:A=USR(LD,1,PM+36):POKE 1585,7:GOSUB 10
00:POKE 705,C
420 IF PEEK(1557)>240 AND PEEK(1561)=193 THEN POKE 1561,57:A=USR(LD,1,PM+21):POKE 1585,11:GOSUB
1000:POKE 705,C
430 IF PEEK(1558)<15 AND PEEK(1562)=81 THEN POKE 1562,169:A=USR(LD,2,PM+36):POKE 1586,7:GOSUB 10
00:POKE 706,C
440 IF PEEK(1558)>240 AND PEEK(1562)=169 THEN POKE 1562,81:A=USR(LD,2,PM+21):POKE 1586,11:GOSUB
1000:POKE 706,C
450 IF PEEK(1559)<15 AND PEEK(1563)=105 THEN POKE 1563,145:A=USR(LD,3,PM+36):POKE 1587,7:GOSUB 1
000:POKE 707,C
460 IF PEEK(1559)>240 AND PEEK(1563)=145 THEN POKE 1563,105:A=USR(LD,3,PM+21):POKE 1587,11:GOSUB
 1000:POKE 707,C
465 REM ** PRINT TIME - CK. FOR TIME UP **
470 TIME=30-PEEK(19):POSITION 15,0:? #6;TIME;" ":IF TIME<=0 THEN 910
472 REM ** RESET SOUND - HORN ROUTINE **
473 SOUND 0,0,0,0
475 IF RND(0)>0.5 THEN SOUND 1,0,0,0
480 IF RND(0)<0.05 THEN SOUND 1,7,12,10
482 REM ** CHICKEN STOMP **
485 P=PEEK(1564):IF P>15 OR P<13 THEN 500
490 IF P=15 THEN A=USR(LD,0,PM):GOTO 500
492 IF FL=I1 THEN FL=I2:SOUND 0,16,6,8:GOTO 496
494 IF FL=I2 THEN FL=I1:SOUND 0,22,6,8
495 REM ** CK. FOR REACHING BOTTOM **
496 A=USR(LD,0,PM+FL)
500 IF PEEK(1560)>230 THEN 810
505 REM ** CK. FOR COLLISION **
510 IF PEEK(53260)=0 THEN 410
515 REM ** SPLAT **
520 A=USR(LD,0,PM+51):FOR J=1 TO 3:SOUND 0,RND(0)*255,8,8:SOUND 1,RND(0)*255,8,8
525 POKE 704,PEEK(704)+8:FOR I=1 TO 30:NEXT I:NEXT J:SOUND 0,0,0,0:SOUND 1,0,0,0:POKE 704,40
527 REM ** DECREASE SCORE - CK FOR 0 **
530 SCORE=SCORE-20:POSITION 3,0:? #6;SCORE;"   ":IF SCORE<=0 THEN 702
533 REM ** MOVE UP - RELOAD BIRD - RESET COLL. **
535 POKE 1560,PEEK(1560)-24:A=USR(LD,0,PM):IF DIF>1 THEN DIF=DIF-1
590 POKE 53278,0:GOTO 395
700 REM ** SCORE = ZERO **
701 REM TYPE IN INVERSE VIDEO
702 POSITION 3,2:? #6;"CHICKEN'S DEAD"
704 REM ** AMBULANCE **
705 C=1
706 IF PEEK(1576+C)=0 THEN C=C+1:GOTO 706
707 IF C>3 THEN C=1
713 POKE 1576+C,1:POKE 1560+C,PEEK(1560):POKE 1556+C,220:A=USR(LD,C,PM+107)
715 FOR J=1 TO 6:FOR P=60 TO 40 STEP -2:SOUND 0,P,10,8:FOR I=1 TO 6:NEXT I
716 NEXT P:FOR P=40 TO 60 STEP 2:SOUND 0,P,10,8:FOR I=1 TO 6:NEXT I:NEXT P:NEXT J:SOUND 0,0,0,0
718 REM ** NEW HIGH SCORE? **
720 A=USR(1546):IF SCORE>HIGH THEN HIGH=SCORE:POSITION 15,22:? #6;HIGH
730 POSITION 2,6:? #6;"press FIRE button":POSITION 4,7:? #6;"to play again"
732 FOR I=53248 TO 53251:POKE I,0:NEXT I:SOUND 0,0,0,0:SOUND 1,0,0,0
735 REM ** WAIT FOR BUTTON **
740 IF STRIG(0)=1 THEN 740
745 REM ** PM GRAPHICS OFF **
750 POKE 53278,0:POKE 53277,0:A=USR(1546):GOTO 280
800 REM ** BK TO TOP - STOP MOVEMENT OF BIRD **
810 POKE 1560,30:A=USR(LD,0,PM):POKE 1576,0
815 REM ** SIGNAL AND INCREMENT SCORE **
820 FOR I=1 TO 5:FOR J=10 TO 5 STEP -1:SOUND 0,J,14,8:SOUND 1,J,2,8:NEXT J:SOUND 0,0,0,0:SOUND 1
,0,0,0
825 A=USR(LD,0,PM+68):FOR J=1 TO RND(0)*30:NEXT J:A=USR(LD,0,PM+88)
830 SCORE=SCORE+DIF*2:POSITION 3,0:? #6;SCORE;"   ":NEXT I
840 IF DIF<9 THEN DIF=DIF+1
841 REM ** CK FOR BONUS **
842 IF SCORE<BONUS THEN 850
844 SOUND 0,25,10,10:BONUS=BONUS+300:P=PEEK(19):IF P<11 THEN POKE 19,0:GOTO 848
846 POKE 19,P-10
848 POSITION BPOS,13:? #6;"*":BPOS=BPOS+1
850 GOTO 390
900 REM ** TIME'S UP ROUTINE **
910 POSITION 5,2:? #6;"TIME'S UP"
920 GOTO 720
990 REM ** CHANGE CAR COLOR SUB.**
1000 CP=CP+1:IF CP=20 THEN CP=1
1010 C=ASC(C$(CP)):RETURN
```

```
10 CLS:PRINT@138,"holiday '83":PRINT"  SEE IF YOU CAN REACH YOUR","  HO
LIDAY DESTINATION IN TIME","  AND AVOID THE HORRORS OF","  THE OPEN ROAD"
20 PRINT@448,"  COPYRIGHT S&K BRAIN 261082"
30 PLAY"O1T4V5GGGL12GO2L4V15DDDL12DL4V25AAAL12AO3L4V30EEEL12EO1L4V25GO2D5AO3L12E
L4O2GGG"
40 CLS0:TIMER=0:DI=500
50 PRINT @448,CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(1
28);CHR$(128)
60 PRINT TAB(A);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$
(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);CHR$(128);:T=TIMER:DI=DI
-1
70 PRINT@52,"T      D";:PRINT@53,USING"####";INT(T/10);:PRINT@59,USING"####";DI:P
RINT@510
80 A=A+(RND(3)-2)
90 IFA<0THENA=0
100 IFA>18THENA=18
110 IFDI=0THEN670
120 POKE1248+Z,128
130 C=PEEK(1312+B):IFC<>128GOSUB230
140 A1=RND(12)-1:A2=(((RND(8)-1)*16)+143):POKE1472+A1+A,A2
150 POKE1280+B,8
160 Z=B:B=B+((JOYSTK(0)-30)/20)
170 IFB<0THENB=0
180 IFB>31THENB=31
190 D=JOYSTK(1):SOUNDC,1
200 FORN=1TOD*5:NEXTN
210 IF PEEK(65280)=126THEN PLAY"T10V31BCBC"
220 GOTO60
230 IF C=96THEN630
240 C=(C-127)/16:ON C GOSUB250,340,380,400,
    430,540,560,590:RETURN
250 PLAY"O1L18AGB":PRINT@0,"BUMP-JOLT",,
    "WATCH OUT FOR POTHOLES!";:PRINT@480," "

260 IF D>32 THEN POT=POT+1ELSEPOT=POT+3
270 IF D<=32 THENDAM=DAM+3
280 IF DAM=>100 THEN 660
290 IFPOT=>6 THEN310
300 FORN=1TO100:NEXTN:RETURN
310 POT=0
320 PRINT@0,"stop!  KIDS SICK";:PRINT@480," ";
330 FORN=1TO1000:NEXTN:RETURN
340 PRINT@0,"ROAD TACKS",,"YOU'VE GOT A PUNCTURE"
350 IFSP=1 THEN650
360 PRINT"stop! & CHANGE TYRE";:PRINT@480," ";
370 SP=1:FOR N=1TO1000:NEXTN:RETURN
380 PRINT@0,"WASHER EMPTY",,"STOP TO CLEAN WINDSCREEN";
    :PRINT@480," ";
390 FOR N=1TO1000:NEXT N:RETURN
400 PRINT@0,"BUMP",,"YOU'VE HIT AN OBSTRUCTION.";:PRINT@480," "
410 FORN=1TO100:NEXTN
420 DAM=DAM+10:IF DAM=>100THEN660
430 IF D<32THEN470
440 B=B+(RND(5)-3)
450 BP=BP+1:IF BP>6THEN500
460 RETURN
470 B=B+(RND(9)-5)
480 BP=BP+3:IF BP>6THEN500
490 RETURN
500 PRINT@0,"TYRE WORN OUT";:PRINT@480," ";
510 FORN=1TO1000:NEXTN
520 IFSP=1THEN650
530 SP=1:RETURN
540 CLS0:PRINT@192,"HEAD ON COLLISION","YOU DIED ";DI;" MILES","FROM YOUR DESTIN
ATION":PLAY"O1V31T2L4GGL8GGL4B-AAGGF+G"
550 FORN=1TO1000:NEXTN:RUN
560 PRINT@0,"YOU'VE KNOCKED SOMEBODY DOWN","POLICE CALLED":PLAY"V1L6T4FGV>FGV>FG
V>FGV>FGV31FG"
570 RAN=RND(4):IF RAN=>3THENPRINT"YOU WERE LUCKY":FORN=1TO500:NEXTN:PRINT@480,"
";:RETURN
580 CLS0:PRINT@192,"YOU'VE BEEN ARRESTED","SPEND HOLIDAY IN JAIL","BETTER LUCK N
EXT YEAR!":PLAY"O3T10BAGFEDCO2T5BAGFEDCO1T1BAGFEDC":FORN=1TO100:NEXTN:RUN
```

GAMES S

NIGH



With Keith Brain's Dragon disaster game you can blithely relish all the catastrophes that plague the holiday motorist without even setting foot on the ferry.

CHRISTMAS IS traditionally the time when everyone starts to think about next year's summer holidays but not, perhaps, the pleasures of holiday motoring. This program will sharpen up your driving skills and remind you of the sad consequences of bad driving.

As you are driving along a road which winds at random through the countryside you are confronted by various obstacles which have different consequences on the outcome of your journey.

Your joystick allows you to steer to left and right, accelerate and brake, whilst the fire button sounds the horn and may help you avoid a problem. With practice you will learn which obstacles must be avoided at all costs.

Your elapsed time and the distance to your destination are continuously displayed but can you get there before the ferry leaves? Did you remember to take those travel-sickness pills and check your tyres? Is it worth risking your driving licence when you already have two endorsements? How long must you wait for the traffic lights to change?

Try it out on your spouse — or your parents — and you might even persuade them that the holiday money is better spent on a new computer for the kids.

Here are some notes to explain the program construction and these will allow you to modify the program to include your own particular holiday terrors. Care must be taken when printing due to the automatic screen scroll on the Dragon. Remember to put the Print position back to where you want to print a new road section and that Poking does not cause a Scroll.

If you really cannot win then you can always change the values of the variables.

Lines 10-40 provide an introduction to the game and set the internal timer and distance to travel. Line 50 prints a blank road for you to start on.

Line 60 prints a new road section at a random Tab on the screen, increments the timer, and decrements the distance left.

Line 70 prints elapsed time and distance to travel in the top right-hand corner, then returns the print position to the bottom of the screen.

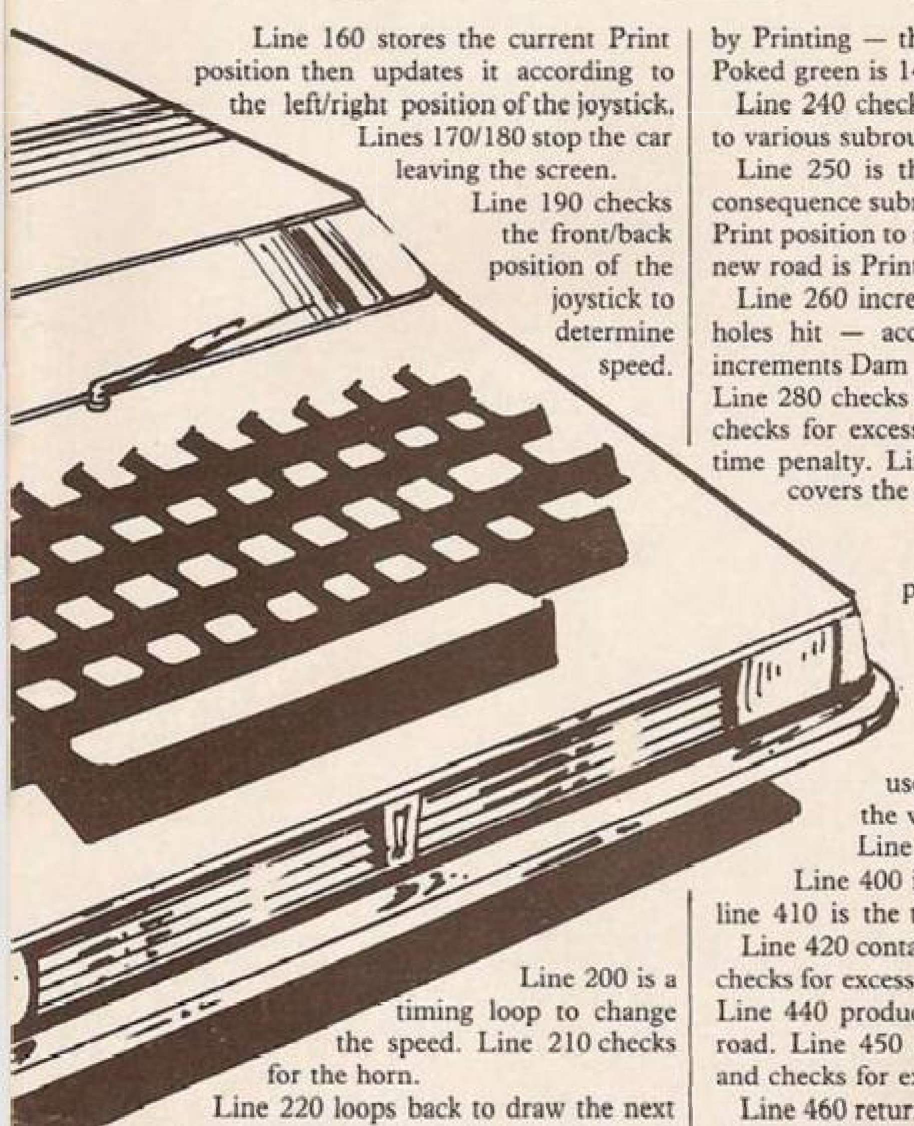
Line 80 determines the random Tab for the next road section. Lines 90 and 100 check that the road will not overflow the screen. Line 110 tests for the end of the journey.

Line 120 Pokes black — 128 — into the current Print position to erase the car after each move.

Line 130 checks for the colour of the next Print position and, if it is not black, goes to the consequences subroutines.

Line 140 Pokes random colours in random positions on to the next road section. Line 150 Pokes the car on to the screen near the centre.

TMARE HOLIDAY



Line 160 stores the current Print position then updates it according to the left/right position of the joystick. Lines 170/180 stop the car leaving the screen. Line 190 checks the front/back position of the joystick to determine speed.

Line 200 is a timing loop to change the speed. Line 210 checks for the horn.

Line 220 loops back to draw the next road section and continues the journey.

Line 230 checks if the car has left the road — note there are two identical greens with different codes on the screen; a green produced by Printing — that is, a space — is 96 but a Poked green is 143.

Line 240 checks for other colours and goes to various subroutines.

Line 250 is the pothole subroutine. Each consequence subroutine ends by returning the Print position to start of bottom line before the new road is Printed.

Line 260 increments Pot — the number of holes hit — according to speed. Line 270 increments Dam — damage — if speed is high. Line 280 checks for excess damage. Line 290 checks for excess potholes. Line 300 gives a time penalty. Line 310 resets Pot. Line 320 covers the consequences of excess Pots. Line 330 is another time penalty line. Line 340, the puncture subroutine. Line 350 checks for a previous puncture.

Line 360, stop to change wheel. Line 370 records the SP — spare — used: time penalty. Line 380 is the washer subroutine.

Line 390 is another time penalty.

Line 400 is the bump subroutine and line 410 is the time penalty.

Line 420 contains the damage subroutine: it checks for excess Dam. Line 430 checks speed. Line 440 produces a random skid across the road. Line 450 increments BP — bumps — and checks for excess.

Line 460 returns to the road. Line 470 gives a bigger skid at high speed: line 480, a bigger BP increment at higher speed: check for excess. Line 490 returns to road.

Line 500, tyre worn out. Line 510, another time penalty line. Line 520 checks if the spare tyre has been used. Line 530 records that a spare tyre has been used. Line 540 is the collison subroutine — always fatal.

Line 550 starts new game. Line 560, accident subroutine: police called. Line 570, random chance of getting off. Line 580 signifies arrest, and starts a new game.

Line 590 is the traffic lights subroutine. Line 600, the random time for waiting on a red light. Line 610, amber traffic light. Line 620, green traffic light.

Line 630 is the crash subroutine; it increments Dam and checks for excess. Line 640 is the time penalty. Line 650, if the spare tyre has already been used, gives the distance covered before end.

Line 660 is the fall-apart subroutine and gives distance to walk home. Line 670 checks for time when the end of road has been reached. Line 680 if not excess, then congratulations. Line 690, new game. Line 700, the consequences of running out of time. Line 710, new game.

For those without joysticks, insert

```
1 D=10
```

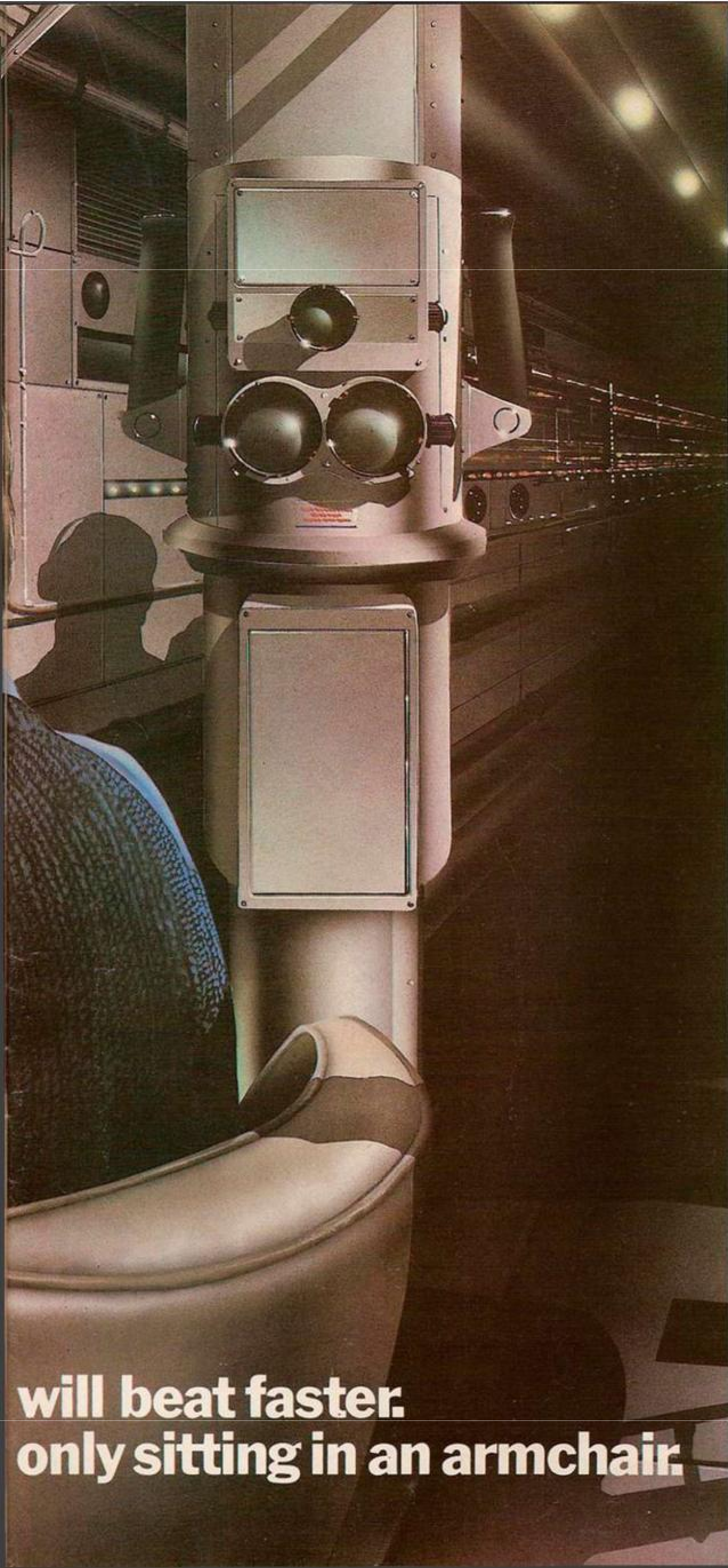
and alter lines 160, 190 and 200 to

```
160 Z=B:BA$ INKEY$: IF BA$"" THEN 170
    ELSE BA=ASC(BA$):
    B=B+((BA=8)-(BA=9))
190 SOUND C,1:D=D+(10*((BA=94)
    -(BA=10))):FOR N=1 TO D*5: NEXT N
200 IF BA=32 THEN PLAY"L4T10V31BCBC":
    BA=0:GOTO 60
```

The left and right cursor keys will now move you left and right, and the up and down cursors accelerate and brake. The space bar is the horn. ■

```
590 PRINT@0,"TRAFFIC LIGHTS"
600 PRINT"RED":FORN=1TO(RND(2000)+500):NEXTN
610 PRINT@32,"AMBER":FOR N=1TO500:NEXTN
620 PRINT@32,"GREEN":PRINT@480," ";:FOR N=1TO500:NEXTN:RETURN
630 PLAY"O1L20CDDT>CDDDT<CCD":PRINT@0,"CRASH";:PRINT@480," ";:DAM=DAM+20:IF DAM=
>100 THEN660
640 FOR N=1TO100:NEXTN:RETURN
650 FORN=1TO1000:NEXTN:CLS7:PLAY"O5T50L1B-A+B-A+B-A+B-A+B-A+B-A+B-A+":PRINT@
192,"YOU HAVE RUN OUT OF TYRES","YOU CAN GO NO FURTHER","YOU ARE STUCK ";DI;" MI
LES","FROM YOUR DESTINATION":FOR N=1TO5000:NEXTN:RUN
660 CLS4:PRINT@192,"YOUR CAR HAS FALLEN APART",(500-DI);" MILES TO WALK HOME":PL
AY"O4V31T155BAGFEDCO3BAGFEDCO2BAGFEDCO1BAGFEDCT2L1C":FORN=1TO1000:NEXTN:RUN
670 IF T>1000 THEN 700FORN=0TO8:CLSN:FORM=1TO300:NEXTM:NEXTN
680 PRINT@200,"CONGRATULATIONS","YOU'VE REACHED YOUR DESTINATION IN ";T;" MINUTE
S"
690 PLAY"O2T5CCCEEEGGGL1O3C":FORN=1TO500:NEXTN:RUN
700 CLS4:PRINT@192,"YOU DIDN'T MAKE IT ON TIME","YOU MISSED THE BOAT","CAMP ON T
HE DOCKSIDE","BETTER LUCK NEXT YEAR!"
710 PLAY"O5T100BAGFEDCO4T<BAGFEDCO3T<BAGFEDCO2T<BAGFEDCO1T<BAGFEDT1L1C":FORN=1TO
1000:NEXTN:RUN
720 PLAY"GGL6GGL4B-AAGGF+G"
```


Your hands will sweat. Your heart
Your oxygen might run out. And you're still



At seventy fathoms the only light comes from your Sonar, steadily tracking the advancing enemy fleet.

Suddenly they're above, dropping depth charges. You could dive. But how close is the sea bed? You could attack. But how many torpedos are left? And your oxygen. Isn't it dangerously low?



Submarine Commander. 12 K ROM. Cartridge. 3 screen modes: map, sonar and periscope. 9 skill levels. Controls: Fuel. Damage Indicators. Speed. Compass Bearing. Depth Gauge. Battery Charge. Oxygen. Hydrophone/ Engine Noise. Attitude. Clock. Depth below keel. Torpedos. Tonnage Sunk.

'Submarine Commander' is one of 21 challenging new home computer games from THORN EMI, for use with Atari 400/800 or Commodore VIC 20. Like our 'Jumbo Jet Pilot' it's more a real-life simulator than a game.

But our programs aren't all work and no play. 'River Rescue', 'Kickback' and 'Soccer' are all-action games. 'Pool' and 'Darts' will suit armchair sportsmen.

And whilst budding Beethovens play the 'VIC Music Composer,' would-be Chancellors can work on their budgets with 'Home Financial Management.' We also have educational puzzles for children that will puzzle adults at higher skill levels.

But there's one simple idea behind all our titles. They're designed for players who expect more of a challenge from a video game than creatures from outer-space can provide. Now, are you sitting comfortably?

THORN EMI VIDEO

The world's greatest TV games.



PROGRAMS FOR ATARI 400/800 (Trademark of Atari Inc. except where indicated).
*PROGRAMS FOR COMMODORE VIC 20 (Trademark of Commodore International).

Available from all branches of Laskys (Nationwide), Micro C at Currys, and all other leading Computer software outlets.

Seize power in your own banana republic with Boylen and Harvey's game of subversion for the Sharp.

El sharpiro is an independent country situated somewhere in the Caribbean. The capital, Diaz, is the only city.

The country is run by an evil dictator, Dr Emmanuel Jesus Ratok who runs the country for his own benefit. Ratok grows richer and the country grows even poorer.

He rules with a fist of iron in a glove of steel; all opposition is crushed by his sadistic army and police.

As leader of the newly-formed El Sharpiro Liberation Organisation — ELO — you have vowed to rid your homeland of this evil dictator and hold free elections for the first time ever.

As Dr Ratok has made himself president for life the only way to get rid of him is to stage a coup and depose him. To do this you must capture the army barracks and get a bazooka to knock out the only tank that guards his palace. To capture the barracks you must have automatic weapons and enough men to use them. The only place with the number of weapons you need is the police station. You must liberate the freedom fighters languishing in the state jail to get the number of men you need.

You can also capture the TV station and the bank. Until you capture the bank the president can use its funds to hire mercenaries. All these buildings are ringed by guard towers and it is very risky to attack the building without destroying its guard tower first.

To destroy the guard towers you need to buy some dynamite from your friendly, rich dealer in death and destruction, Adam Khagosshi.

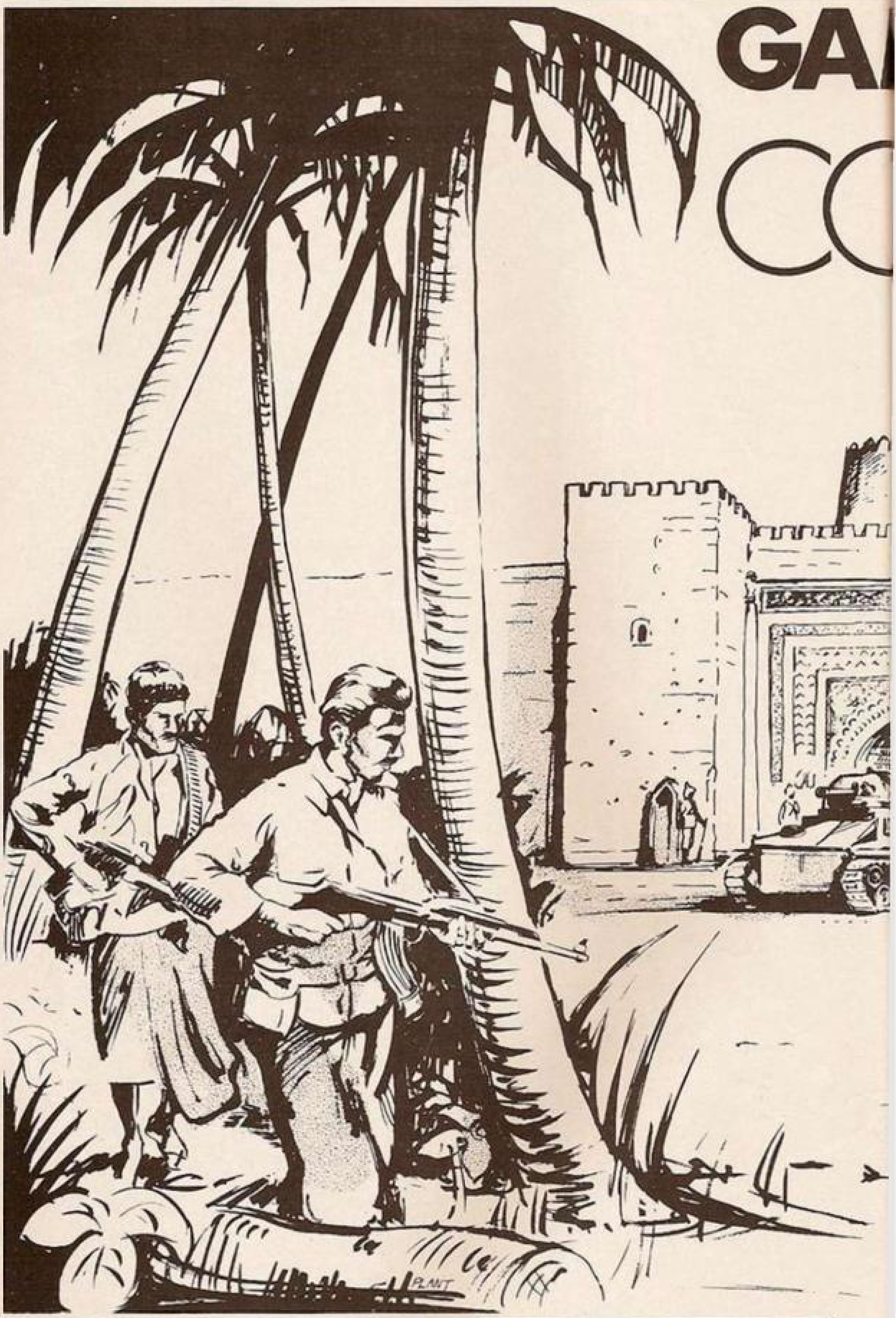
The towers are randomly numbered and, with luck, you may just get a quick look at a secret map with locations on it. It may help you get some of your men out of prison if you have a boat. You can also free some of your captured lieutenants who are held in the top-security wing by buying a helicopter if you can afford it. If you attempt an escape by sea a rope may come in handy.

Kidnapping is another way to free your friends and increases the fighting fund. If your popularity, U.S. backing, ELO membership or number of lieutenants fall below one your coup d'état has failed.

The opposition consists of: Dr Ratok — the president; General Jung — the chief of staff; Lt Lapidus — chief interrogator; and Sgt Sadoul — the executioner. There may be other characters that may become involved — they may help you or they may help the enemy.

ELO membership is restricted to a maximum of 300 until you liberate your men from prison. You may not have more than 20 lieutenants. The maximum number of safe houses is 30. You may purchase hand-guns and rifles, but the minimum order is 300 — in order to get your discount. These will increase your attacking power. You may not visit the same location twice in a row — bad for security.

You and your men face a powerful and ever-vigilant enemy, the fight will be long and hard with little chance of success. We, the people, wish you luck.

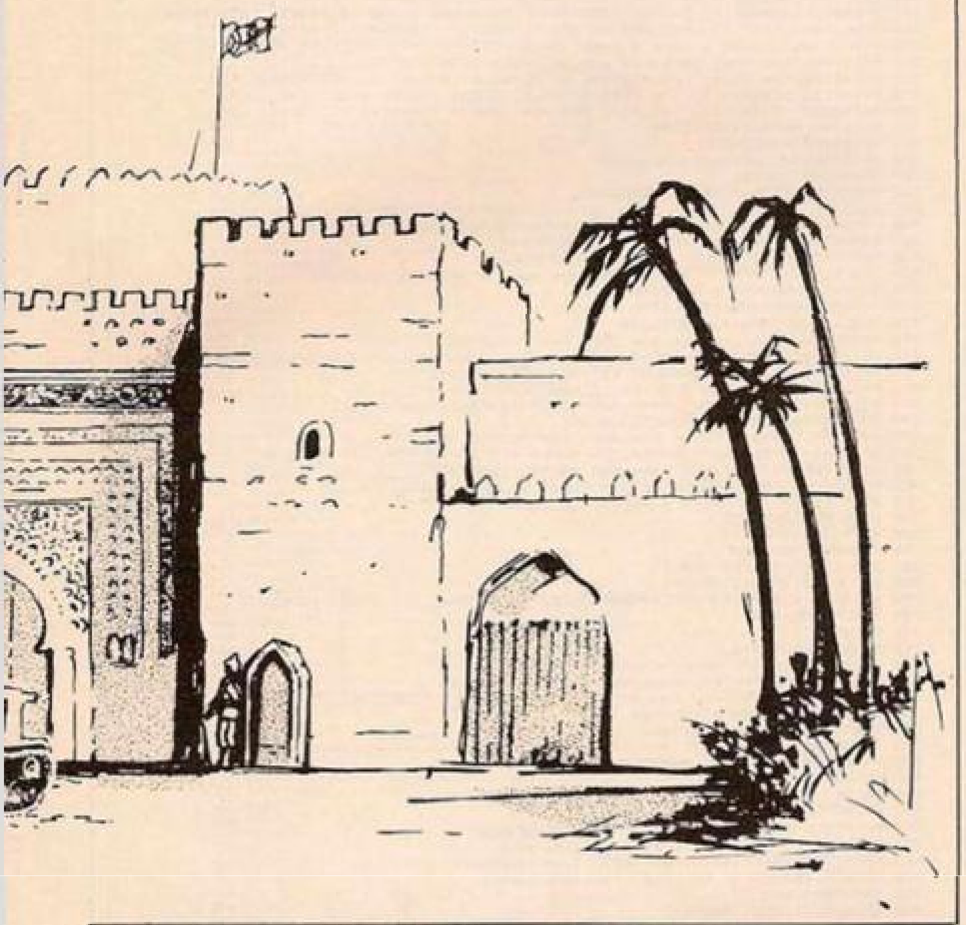


The main variables.

BZ	Bazooka
BA	Bank
BT	Boat
DT	Dynamite
DY	RND. Price of dynamite
EL	ELO membership
ES	Enemy strength
FA	Failure flag
FO	Food
GA	Prision guards
GB	Gold bars
HA	RND. Price of hand-guns
HD	Helicopter damage
HE	Helicopter
HS	Hostages
JP	Jeep
LO	Location
PH	Police station
PL	Police numbers
PR	Prison
PS	Popular support
MP	Map
MO	Input move
MY	ELO fighting fund
MV	Number of moves taken
NL	Number of lieutenants
NS	Number of safe houses
NX	Saves number of last move
RI	RND. Price of rifles
RD	Radio station
RP	Number of ropes
RS	Ransom
TK	Tank
TV	TV station
UF	United States friendship
VR	Video recorders
Y	Poke to screen
Z	Tabset then variable used to Poke screen address — introduction

MES SPECIAL

UP D'ÉTAT



```
1 X=53248:Z=7:PRINT"■■■■■■■■■";TAB(Z);"      ▄▀▀▀▄ "
2 PRINTTAB(Z);"   ▐▀▀▀▀▀▀▀▛▀▀▀▀▀▀▀▀▀▀"
3 PRINTTAB(Z);"         ▀▀▀▀▀"
4 PRINTTAB(Z);"  ▄▆▆▆▆▆▆▆▆▆▆▆▆▆▆▆▆▆▆▄"
5 PRINTTAB(Z);" ▆▆▆▆▆▄▆▆▆▆▆▄▆▆▆▆▆▆▆▆▆"
6 PRINTTAB(Z);" ▛ □ □ □ □ □ □ □  ▜"
7 PRINTTAB(Z);"  ╰──────────────╯"
8 FORW=1TO3000:NEXT:Z=0:Y=386:GOSUB19
9 Y=370:GOSUB19:Z=67:Y=371:GOSUB19
10 Z=0:Y=385:GOSUB19:Y=384:GOSUB19
11 Y=371:GOSUB19:Y=383:GOSUB19
12 Y=382:GOSUB19:Z=67:Y=376:GOSUB19
13 Z=0:Y=381:GOSUB19:Z=67:Y=375:GOSUB19
14 Z=0:Y=380:GOSUB19:Z=67:Y=374:GOSUB19
15 Z=0:Y=379:GOSUB19:Z=67:Y=373:GOSUB19:Y=372:GOSUB19
16 Z=74:Y=378:GOSUB19:Z=67:Y=379:GOSUB19
17 Z=74:Y=377:GOSUB19:Z=67:Y=378:GOSUB19
18 Z=74:Y=376:GOSUB19:Z=67:Y=377:GOSUB19:GOTO20
19 POKE(X+Y),Z:RETURN
20 FORZ=1TO1000:NEXT:PRINT"■"
21 Z=71:Y=290:GOSUB34:Y=249:GOSUB34:Y=248:GOSUB34:GOSUB34
22 Y=248:GOSUB34:GOSUB34:Y=247:GOSUB34:Y=286:GOSUB34
23 Y=326:GOSUB34:Y=366:GOSUB34:Y=406:GOSUB34:Y=446:GOSUB34
24 Y=487:GOSUB34:Y=488:GOSUB34:Y=489:GOSUB34:Y=450:GOSUB34
25 Y=495:GOSUB34:Y=496:GOSUB34:Y=497:GOSUB34:Y=458:GOSUB34
26 Y=418:GOSUB34:Y=378:GOSUB34:Y=337:GOSUB34:Y=336:GOSUB34
27 Y=335:GOSUB34:Y=374:GOSUB34:Y=374:GOSUB34:Y=414:GOSUB34
28 Y=454:GOSUB34:Y=342:GOSUB34:Y=382:GOSUB34:Y=422:GOSUB34
29 Y=462:GOSUB34:Y=503:GOSUB34:Y=504:GOSUB34:Y=504:GOSUB34
30 Y=505:GOSUB34:Y=466:GOSUB34:Y=426:GOSUB34:Y=386:GOSUB34
31 Y=346:GOSUB34:Y=510:GOSUB34:Y=470:GOSUB34:Y=430:GOSUB34
32 Y=390:GOSUB34:Y=350:GOSUB34:Y=351:GOSUB34:Y=352:GOSUB34
33 Y=393:GOSUB34:Y=432:GOSUB34:Y=431:GOSUB34:GOTO35
34 POKE(X+Y),Z:TEMPO7:MUSIC"CR1":RETURN
35 PRINT"■■■■■■■■■■■■■■■■          ▛▚ ▛▀ ▀▛ ▀▀▀ ▀▛"
36 PRINT"            ▌ ▌ ▙  ▌ ▌▬▌  ▌"
37 PRINT"            ▀▀ ▀▀ ▗ ▌ ▌  ▌"
39 DEF FNA(X)=1+INT(RND(4)*X)
40 DIMC$(2),D$(2):FORA=1TO2:READC$(A):READD$(A):NEXT
41 DIMH$(4):FORA=1TO4:READH$(A):NEXT
42 DIMIN$(4),TW$(4):FORA=1TO4:READIN$(A):READTW$(A):NEXT
43 DIMTR(13),PT(13),I(13):FORA=1TO13:TR(A)=1:NEXT:FORA=1TO13
44 B=FNA(13):IFPT(B)>0THEN44
45 PT(B)=A:NEXT
46 DIMSH(30):FORZ=1TO10:NS=10
47 HO=FNA(30):IFSH(HO)=1THEN47
48 SH(HO)=1:NEXTZ:DIMTN(13)
49 DIMAM$(5):FORE=1TO5:READAM$(E):NEXTE:M$="Your■Man ":ME$="Your Men have "
50 W=1:PS=50:EL=100:NL=15:MY=1000:UF=40:ES=2000:PL=1000:MV=0:TK=1:GA=300
51 PRINT"■":FORA=0TO2
52 PRINT"■■          ▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄ "
53 PRINT"          ▌                  ▐"
54 PRINT"          ▌      ******      ▐"
55 PRINT"          ▌                  ▐"
56 PRINT"          ▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀":FORB=0TO200:NEXTB
57 PRINT"■■■■■■■■■■■■■■■■■■■■■■■STATUS":FORC=0TO100:NEXTC:NEXTA:PRINT"■■■"
58 PRINT"■U.S.Friendship:      ";UF;"%"
59 PRINT:PRINT"■E.L.O. Forces:       ";EL
60 PRINT:PRINT" Popular Support:     ";PS;"%"
61 PRINT:PRINT" No. of Lieutenants:  ";NL
62 PRINT:PRINT" Fighting Fund:       ";MY;" Dollars"
63 PRINT:PRINT" No.■of Safe Houses:  ";NS
64 PRINT:PRINT" Type of Weapons:     ";TW$(W)
65 FORA=0TO7000:NEXT
66 IF(NL<1)+(EL<1)+(PS<1)+(UF<1)THEN747
67 IF(BT=0)*(EL>300)THENEL=300
68 IFES<0THENES=0
69 IFUF>100THENUF=100
70 IFPL<0THENPL=0
71 IFPS>100THENPS=100
72 IFNL>20THENNL=20
73 PRINT"■■          ▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄ "
74 PRINT"          ▌                  ▐"
75 PRINT"          ▌      MOVE        ▐"
76 PRINT"          ▌                  ▐"
77 PRINT"          ▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀":PRINT"■■■(0) Map"
78 PRINT"■■(1) Status              (2) Ghetto■"
79 PRINT"■(3)■Bank                (4) Harbour■"
80 PRINT" (5) Square              (6) T.V. Station■"
81 PRINT" (7) Police Station      (8) Hotel■"
82 PRINT" (9) Prison              (10) Church■"
83 PRINT" (11) Barracks           (12) Palace■■":GOSUB471
84 INPUT MO:IF(MO=NX)*(MO>1)THENPRINTM$;"has just been there":GOTO84
85 IFMO=0THEN472
86 IFMO=1THEN51
87 NX=MO:MV=MV+1:IFMO=2THEN99
88 IFMO=3THEN117
89 IFMO=4THEN134
90 IFMO=5THEN157
91 IFMO=6THEN175
92 IFMO=7THEN216
93 IFMO=8THEN253
94 IFMO=9THEN290
95 IFMO=10THEN324
96 IFMO=11THEN338
97 IFMO=12THEN378
98 PRINT"Press the right Button EL'DUMBO!!!":GOTO84
99 GOSUB636:A=FNA(6):ONAGOTO102,104,107,111,112
100 IFTV=0THENGOSUB424:PS=PS-FNA(8)+2:GOTO396
101 GOTO111
102 S=INT((FNA(3)*PS)/10):PRINTS;"■New Recruits ask to Join the E.L.O."
103 EL=EL+S:GOTO396
104 S=FNA(40):GOSUB800:PRINTME$;"been Ambushed by the Army":EL=EL-S
105 GOTO396
106 S=FNA(10)
107 IFFO>0THENPRINT"Your People give Food to the Poor":PS=PS+S:GOTO110
108 PRINT"The People are not too chuffed that You Haven't BROUGHT any FOOD"
109 PS=PS-S:GOTO396
110 FO=FO-1:GOTO396
111 S=FNA(14):PRINT"  One of Your Men Robs A U.S. Reporter":UF=UF-S:GOTO396
112 IFTR(13)=0THEN99
113 PRINT"Your Truck is Searched on the Bridge":Y=FNA(2)
114 IFY=1THENPRINT"They Couldn't Find an ELEPHANT":GOTO396
115 IFFO>0THENPRINT"They Confiscate Your Food":FD=0:GOTO396
116 PRINT"They Arrest the Drivers":EL=EL-3:GOTO396
117 GOSUB680:A=FNA(3):ONAGOTO122,123
118 K=FNA(7):IF(BA>0)*(K<3)*(ES>BA)THENPRINT"The Bank has Been RECAPTURED":K=9
119 IFK=9THENEL=EL-BA:BA=0:GOTO396
120 IFK>5THENPRINT"You've Been Given Some Cash":MY=MY+FNA(4)*PS:GOTO396
121 PRINTM$;"Still can't get a loan":GOTO396
122 GOTO797
123 S=INT(ES/6):EN$=" Soldiers":GOSUB466
124 IFA$="N"THEN396
125 LO=BA:N=4:LT$=" Bank":RS=0:MS=FNA(1200):M=FNA(5):T=10
126 GOSUB398:IFFA=1THENFA=0:GOTO396
127 IFAC=2THENES=ES-S:GOTO396
128 IFAC=1THENBA=Z:MY=MY+MS:GOTO396
129 IFAC=3THENES=ES-S:GOTO396
130 IFAC=4THEN396
131 IFAC=5THENM=M*S
132 PRINT"They Take";M;" Dollars,You Get";MS
133 MY=MY+MS-M:GOTO396
134 GOSUB556
135 A=FNA(6):ONAGOTO151,145,143,152,154
136 K=FNA(7)
137 IF(K<4)*(ES>10)*((TR(13)=1)+(TR(12)=1))THEN139
138 GOTO140
139 GOSUB800:PRINTM$;"DIDN'T Get Past The Tower":NL=NL-1:GOTO396
140 IFK>5THENPRINT"You've got■A Contribution":MY=MY+FNA(4)*PS:GOTO396
141 IF(K=1)*(RD=0)THENPRINT"Your Mans Found A Crate of Radios":RD=1:GOTO396
142 PRINT"Water Looks Dirty":GOTO396
143 IFTV=0THENGOSUB424:GOTO396
144 GOTO135
145 IFBO=1THEN135
146 PRINTM$;"Sees A Motor Boat At The Quay"
147 PRINT" Would You like to BORROW it ?":GOSUB468
148 IFA$="N"THEN396
149 S=FNA(6):IFS>2THENPRINT"■Nice Boat You've got there":BO=1:GOTO396
150 PRINT"■■Unfortunatly ";M$;"forgot he CAN'T■■■■■SWIM":NL=NL-1:GOTO396
151 GOTO434
152 IFTR(12)=1THENGOTO797
153 PRINT"Not Much Doing":GOTO396
154 PRINTM$;"is Shot at":GOSUB800:A=FNA(2)
155 IFA=1THENPRINT" THEY MISSED":GOTO396
156 IFA=2THENPRINT" GOOD SHOT Unfortunatly":NL=NL-1:GOTO396
157 GOSUB700
158 A=FNA(5):ONAGOTO171,159,160,168,172
159 HO=FNA(PS/4):IF(SH(HO)=0)*(PS>55)THENSH(HO)=1:GOTO167
160 LO$="The Square"
161 PRINTLO$;" has Been SURROUNDED by Troops":GOSUB801
162 PRINTM$;"Must Go■to A Safe House"
163 PRINT"Choose From 1-30":GOSUB471:INPUTHO
164 IF(HO<0)+(HO>30)THENPRINT"I realise illiteracy is common here BUT":GOTO163
165 IFSH(HO)=0THENPRINT"The House as Been BETRAYED":NL=NL-1:GOTO396
166 PRINT" PHEW That was Close":GOTO396
167 PRINT"■You have GAINED A Safe House":NS=NS+1:GOTO396
168 IF(HE=1)*(HD=1)THENPRINT"A Box of Helicopter Spares have Fallen":GOTO170
169 GOTO158
170 PRINT"off the Back of A Lorry.NUDGE!NUDGE!":HD=0:GOTO396
171 GOTO434
172 PRINTM$;"Meets A Shady Looking Trader"
173 IF(FO>0)+(RD=1)+(VR=1)+(GB=1)+(JP=1)THEN455
174 PRINT"■■Who sells him some DIRTY Postcards":GOTO396
175 GOSUB519:A=FNA(5):ONAGOTO182,191,194,197
176 K=FNA(7)
177 IF(TV>0)*(K<3)*(PL>TV)THENPRINT"The T.V.Station as Been RECAPTURED":K=9
178 IFK=9THENEL=EL-TV:TV=0:GOTO396
179 IFK>5THENPRINT"You've Been given A Contribution":MY=MY+FNA(4)*PS:GOTO396
180 IF(K=1)*(VR=0)THENPRINTM$;"Finds Some VIDEO RECORDERS":VR=1:GOTO396
181 PRINTM$;"gets a part in■RATOK STREET":GOTO396
182 S=INT(PL/4):EN$=" Police":GOSUB466
183 IFA$="N"THENGOTO396
184 LO=TV:N=4:LT$=" T.V.Station":RS=0:P=FNA(5)+1:M=FNA(5):T=4
185 GOSUB398:IFFA=1THENFA=0:GOTO396
186 IFAC=2THENPL=PL-S:GOTO396
187 IFAC=1THENTV=Z:PS=100:GOTO396
188 IFAC=3THENPL=PL-S:GOTO396
189 IFAC=5THENPRINT"The Police Take";M;" Each and You Broadcast":PS=PS+P
190 MY=MY-M*S:GOTO396
191 Y=FNA(2):PRINTM$;"has Been SHOT by Guards":GOSUB800
192 IF(Y=1)*(TR(3)=1)+(TR(4)=1)THENPRINT"Stone DEAD!":NL=NL-1:GOTO396
193 PRINT"Only winged him":GOTO396
194 S=FNA(2):PRINTM$;"is Shot at by Soldiers":GOSUB800
195 IFS=1THENPRINT"■They■Couldn't Hit A BUS":GOTO396
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(continued on next page)

(continued from previous page)

COUP D'ÉTAT

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196 PRINT"■Thats One Less For Dinner":NL=NL-1:GOTO396
197 PRINTM$;"Meets A Government Contact":IFHS>0THEN199
198 PRINT"Who Says Some RUDE Things About YOU":GOTO396
199 PRINT"Do You Wish To Exchange Hostages"
200 GOSUB468
201 IFA$="N"THEN396
202 M=FNA(200)+200
203 IFLL>0THENN$=" LT.Lapidus":S=1:GOSUB210
204 IFY=1THENLL=0:MY=MY+M:HS=HS-1:NL=NL+SS:GOTO396
205 IFCL>0THENN$=" Capt.Le Shan":S=2:M=M*2:GOSUB210
206 IFY=1THENCL=0:MY=MY+M:HS=HS-1:NL=NL+SS:GOTO396
207 IFGJ>0THENN$=" Gen.Jung":S=3:M=M*3:GOSUB210
208 IFY=1THENGJ=0:MY=MY+M:HS=HS-1:NL=NL+SS:GOTO396
209 GOTO396
210 SS=FNA(S)+1:PRINT" The Government Offers to Release":SS
211 PRINT"Lieutenants and Donate ";M;" Dollars for";N$
212 PRINT"Do You Except"
213 GOSUB468
214 IFA$="Y"THENY=1:RETURN
215 Y=0:RETURN
216 GOSUB661: A=FNA(6):ONAGOTO224,239,241,251,252
217 K=FNA(7)
218 IF(PH>0)*(K<3)*(ES>PH)THENPRINT"The Police Station as Been RETAKEN":K=9
219 IFK=9THENEL=EL-PH:PH=0:GOTO396
220 IFK>5THENPRINT"You've Been Given A Contribution":MY=MY+FNA(4)*PS:GOTO396
221 IF(K=2)+(K=3)THEN377
222 IF(K=1)*(GB=0)THENPRINT"You've Acuired A GOLD BAR":GB=1:GOTO396
223 PRINTM$;"is Given A Signed Photo of the Football Team":GOTO396
224 S=PL:EN$=" Police":GOSUB466
225 IFA$="N"THEN396
226 LO=PH:N=4:LT$=" Police Station":RS=1:T=9:M=FNA(500)
227 GOSUB398:IFFA=1THENFA=0:GOTO396
228 IFAC=2THENPL=PL-S:GOTO396
229 IFAC=1THENPH=Z:PL=0:PRINT"You NOW have Automatic Weapons":W=4:GOTO396
230 IFAC=3THENPL=PL-S:GOTO396
231 IF(AC=4)*(CL=0)THENB=FNA(3):GOTO236
232 IFAC=4THEN323
233 IFAC=5THENY=FNA(2)
234 IFY=1THENPRINT"■The Reply is Not Printable":GOTO396
235 PRINT"I'll leave a cell door open for";M;"dollars":MY=MY-M:NL=NL+2:GOTO396
236 C=FNA(Z):IFB=1THENPRINT"Your Attempt FAILED and You Lost";C;"Men"
237 IFB=1THENEL=EL-C:GOTO396
238 PRINT"You Have CAPTURED Capt Le Shan":CL=2:HS=HS+1:GOTO396
239 PRINT"You've LIBERATED Some Food Supplies":PRINT"From the Kitchens"
240 FO=FO+1:GOTO396
241 J=FNA(6):IF(J=5)*(W>1)THENPRINT"Your Arms Store is FOUND":W=1:GOTO396
242 IF(TR(13)=1)*(J=6)THEN250
243 IF(J=1)*(DT>0)THENPRINT"Your Dynamite Has Been Discovered":DT=0:GOTO396
244 IF(J=2)*(HD=1)THENPRINT"Your Given Some Chopper Spares":HD=0:GOTO396
245 PRINTM$;"is Recognised and Runs for A   Safe House":GOSUB801
246 PRINT"Which One ?(1-30)":GOSUB471
247 INPUTA:IF(A<0)*(A>30)THENPRINT"Try again STUPID!"
248 IFSH(A)=1THENPRINT"NO SWEAT":GOTO396
249 PRINT"IT WASN'T VERY SAFE":NL=NL-1:GOTO396
250 PRINT"The Bridge Tower Has Been Abandened":TR(13)=0:TN(13)=MV:GOTO396
251 IFTR(10)=1THENGOTO797
252 GOTO377
253 GOSUB505:A=FNA(5):B=FNA(10*UF)+100
254 ONAGOTO258,274,276,277
255 PRINT:PRINTM$;"is Contacted by";C$(FNA(2))
256 PRINT"■■■(The Well Known C.I.A Agent)"
257 PRINT"■Who■Gives Him ";B;" Dollars in A";H$(FNA(4)):MY=MY+B:GOTO396
258 PRINT:PRINTM$;"is Contacted by";D$(FNA(2));" Who":M=FNA(300)+50
259 PRINT"■■Offers to Sell Information for";M;"      Dollars Will You BUY ?"
260 IFM>MYTHENPRINT"He wont take I.O.Us":GOTO396
261 GOSUB468:IFA$="N"THEN396
262 MY=MY-M:N=FNA(4):PRINTI$(N):IF(N=1)+(N=2)THEN264
263 PRINT"Not A Lot of People Know That":GOTO396
264 PRINT"Would You like to Try A Kidnap"
265 GOSUB468
266 IFA$="N"THEN396
267 IF(N=1)*(GJ>0)THEN273
268 IF(N=2)*(CL>0)THEN273
269 Y=FNA(2):IFY=1THENPRINT"You've Got Him":GOTO271
270 PRINT"Good Try.BAD RESULT":NL=NL-1:GOTO396
271 IFN=1THENGJ=1:HS=HS+1:GOTO396
272 IFN=2THENCL=1:HS=HS+1:GOTO396
273 PRINT"It seems someones beat you to it":GOTO396
274 IFTR(13)=1THENGOTO797
275 PRINT"Nice Hotel This":GOTO396
276 GOSUB800:PRINTM$;"is SHOT by POLICE ":NL=NL-1:GOTO396
277 IF(BA=0)*(ES<2000)THEN279
278 GOTO275
279 PRINT"Dr.Ratoks just hired some mercenries":ES=ES+FNA(2000-ES):GOTO396
280 GOSUB597:A=FNA(3):ONAGOTO287,154,306
281 K=FNA(7)
282 IF(PR>0)*(K<3)*(ES>PR)THENPRINT"The Prison has Been RECAPTURED":K=9
283 IFK=9THENEL=EL-PR:PR=0:GOTO396
284 IFK>5THENPRINT"You've Smuggled in Some Food":PS=PS+FNA(15):GOTO396
285 IFK<6THENPRINTM$;"has Got Evidence of Torture":UF=UF+FNA(12):GOTO396
286 PRINT"I like these Neo-Gothic Buildings":GOTO396
287 PRINT"Do You Wish to Attempt A Rescue:"
288 PRINT"■(1)■By Sea":PRINT"■(2)■By Air":PRINT"■(3) No Way"
289 GETA:IF(A<1)+(A>3)THEN289
290 S=FNA(4):IFA=3THEN66
291 IF(A=2)*((HE=0)+(HD=1))THENPRINT"■Arm Flapping is Tiring Work":GOTO396
292 IF(A=1)*(BO=0)THENPRINT"■The SHARKS Enjoyed the Meal":NL=NL-1:GOTO396
293 IF(A=1)*(RP=0)*(S>2)THENNL=NL-1:GOTO305
294 IF(A=1)*(S>2)THENPRINTM$;"Scaled the Cliffs and Rescued":GOTO302
295 SS=FNA(15)+5:IF(A=1)*(S=1)THENPRINTM$;"has Rescued";SS;" Comrades"
296 IF(A=1)*(S=1)THENEL=EL+SS:GOTO396
297 IF(A=1)*(S>1)THENPRINTM$;"Was Caught On The Beach ";:GOTO301
298 SS=FNA(2)+1:IFA=2THENPRINTSS;" Lieutenants have Been Rescued":NL=NL+SS
299 S=FNA(7):IFS>5THENPRINT"Your Helicopter was Damaged":HD=1
300 GOTO396
301 PRINT"Making Sand Castles":NL=NL-1:GOTO396
302 SS=FNA(15)+5:PRINT"■■";SS;" Comrades":EL=EL+SS:M=FNA(2)
303 IFM=1THENPRINT"But the FOOL Left The ROPE Behind":RP=RP-1
304 GOTO396
305 PRINTM$;"Fell Scaling the Cliffs":GOTO396
306 S=GA:EN$=" Guards":GOSUB466
307 IFA$="N"THEN396
308 LO=PR:N=4:LT$=" Prison":RS=1:M=1:IFTR(2)=1THENT=2
309 IFTR(4)=1THENT=4
310 IFTR(6)=1THENT=6
311 R=FNA(400)+800:GOSUB398:IFFA=1THENFA=0:GOTO396
312 IFAC=2THENGA=GA-S:GOTO396
313 IFAC=1THENPR=Z:EL=EL+R:GOTO396
314 IFAC=3THENGA=GA-S:GOTO396
315 IFAC=4THENY=FNA(3):GOTO320
316 IFAC=5THENY=FNA(2):M=M*S
317 IFY=1THENPRINT"We Don't Take Bribes from Plebs":NL=NL-1:GOTO396
318 IFY=2THENPRINT"O.K.I'll Deliver The Cake(with File) For";M;" Dollars"
319 IFY=2THENMY=MY-M:NL=NL+J:GOTO396
320 IF(Y=1)*(LL=0)THENPRINT"Lt.Lapidus is Now Your Guest":LL=1:HS=HS+1:Y=5
321 IFY=5THEN396
322 IFY=2THENPRINTM$;"BUNGLED it":NL=NL-1:GOTO396
323 PRINT"There was No One Worth Kidnapping":GOTO396
324 GOSUB575:A=FNA(5):ONAGOTO325,326,337,336:GOTO197
325 LO$="The Church":GOTO161
326 PRINTD$(FNA(2));" Tells You that an Ambassador is  COMING.";
327 PRINT"How about Kidnapping Him?"
328 GOSUB468
329 IFA$="N"THEN396
330 S=FNA(5):PRINT"You've Grabbed the";AM$(S);" Ambassador"
331 IFS=5THENPRINT"This was NOT A Smart Move":UF=UF-18:GOTO396
332 IFS=3THENPRINT"What Are You Trying for EXCOMMUNICATION":PS=PS-18:GOTO396
333 PRINT"How Many Dollars will You Ask For":GOSUB471:INPUTM
334 J=FNA(500)+500:IFM>S*JTHENPRINT"It Seems■You Can KEEP HIM":GOTO396
335 PRINT"Its A DEAL":MY=MY+M:GOTO396
336 PRINT"Alright who Stole The Poor Box":PS=PS-FNA(14):GOTO396
337 PRINTM$;" gets a rundown of assets":GOTO784
338 GOSUB722:A=FNA(5):ONAGOTO345,356,361,377
339 K=FNA(7)
340 IF(BT>0)*(K<3)*(PL>BT)THENPRINT"THE BARRACKS HAVE BEEN RECAPTURED":K=9
341 IFK=9THENEL=EL-BT:BT=0:GOTO396
342 IFK>5THENPRINT"You've Liberated some Money":MY=MY+FNA(100):GOTO396
343 IF(K=1)*(JP=0)THENPRINTM$;"has Found An Army Jeep":JP=1:GOTO396
344 PRINTM$;"is Asked if He'd like to JOIN■UP":GOTO396
345 G=FNA(13):IFTR(G)=1THEN348
346 IFMV-TN(G)<20THEN345
347 PRINT"No.";PT(G);" Guard Tower has Been Rebuilt":TR(G)=1:GOTO396
348 GOSUB613:PRINT"No.";PT(G);" Guard Tower is without Ground"
349 PRINT"Cover.Do You Fancy Blowing it up"
350 GOSUB468
351 IFA$="N"THEN396
352 IFDT<1THENPRINT"What with ? !A BIKE PUMP!":GOTO396
353 S=FNA(2):Z=FNA(20)+8:IFS=1THENPRINT"The Butterfingered IDIOTS have BLOWN"
354 IFS=1THENPRINT"■THEMSELVES UP":EL=EL-FNA(10)+10:DT=DT-1:GOTO396
355 PRINT"Thats what I call A BANG":TR(G)=0:TN(G)=MV:DT=DT-1:PL=PL-Z:GOTO396
356 PRINTM$;"has Been Captured and is being INTERROGATED"
357 PRINT"He has given the Address of A House":S=FNA(30):IFSH(S)=1THEN359
358 PRINT"It belongs to the PRESIDENTS MISTRESS":EL=EL-1:GOTO396
359 J=FNA(20)+2:PRINTJ;" of Your Men are CAUGHT There":EL=EL-(J+1)
360 SH(S)=0:NS=NS-1:GOTO396
361 IFES<200THENES=200
362 S=ES:EN$=" Soldiers":GOSUB466
363 IFA$="N"THEN396
364 B=2:FORA=1TO4:IFTR(A)=1THENB=A
365 NEXT
366 LO=BA:N=4:LT$=" Barracks":RS=1:M=FNA(1000):T=B
367 GOSUB398:IF(AC=1)*(W<4)*(PR=0)THENFA=1
368 IFFA=1THENPRINT"BAD LUCK":FA=0:GOTO396
369 IFAC=1THENBT=Z:BZ=1:PRINT"You Now Have a BAZOOKA":GOTO396
370 IFAC=2THENES=ES-S:GOTO396
371 IFAC=3THENES=ES-S:GOTO396
372 IFAC=4THENY=FNA(3):GOTO374
373 PRINT"You Can't Match the DOCS Pay":GOTO396
374 IF(Y=3)*(GJ=0)THENPRINT"Gen.Jung is now Your Guest":GJ=1:HS=HS+1:GOTO396
375 IFY<3THENPRINTM$;"BUNGLED it":NL=NL-1:GOTO396
376 PRINTME$;"Captured A Crate of Beer":GOTO396
377 PRINTM$;"Sees A MAP":MP=1:FORA=0TO900:NEXT:GOTO472
378 GOSUB539:S=FNA(2):ONSGOTO379,383
379 PRINTM$;"sees A Cuban Advisor.":S=FNA(4)
380 IF(S=1)+(S=2)THENPRINTME$;"CAPTURED Him":UF=UF+FNA(14):GOTO396
381 IFS=3THENPRINTM$;"is Captured":NL=NL-1:GOTO396
382 PRINT"How EMBARASSING he's A Cigar Salesman":GOTO396
383 S=400:EN$=" Soldiers":GOSUB466
384 IFTR(5)=1THENT=5
385 IFTR(3)=1THENT=3
386 IFA$="N"THEN396
387 N=8:LT$=" Palace":RS=1
388 GOSUB398:IFFA=1THEN392
389 IF(AC=1)*(BZ=0)THENPRINT"■■■■■■■■■";ME$;"been WIPED OUT":GOTO392
390 IFAC=1THEN744
391 GOTO393
392 EL=EL-Z:GOTO396
393 IF(AC=2)+(AC=3)THENES=ES-S:GOTO396
394 IFAC=4THENPRINT"You must be JOKING":GOTO396
395 IFAC=5THENPRINT"you couldn't Pay Our Bar Bill":GOTO396
396 IFA$="N"THENA$="0":GOTO66
397 FORA=0TO6000:NEXT:GOTO66
398 IFLO>0THENPRINT"IDIOT You've already Liberated the";LT$:GOTO396
399 PRINT"■■          ■■■■■■■■■■■■■■■■■■■■■■ ";L=0
400 PRINT"              ■                    ■"
401 PRINT"              ■      ACTION        ■"
402 PRINT"              ■                    ■"
403 PRINT"              ■■■■■■■■■■■■■■■■■■■■■■■■■■"
404 PRINT"■(1) Capture■";PRINT" (2) Raid■"
405 PRINT"■(3)■Assassinate■";PRINT" (4) Kidnap■"
406 PRINT" (5) Offer Bribes■";PRINT:GOSUB471
407 INPUTAC:FA=0
408 IF(AC=1)+(AC=2)THEN410
409 GOTO419
410 INPUT"■■How Many Men Will You Send";Z:Y=Z*W
411 U=S*FNA(2)+2:IFZ>ELTHENPRINT"Your not that popular":GOTO408
412 IF(AC=1)+(AC=2)*(Y<U)THEN415
413 K=FNA(6):IF(AC=1)+(AC=2)*(TR(T)=1)*(K>2)THEN415
414 GOTO416
415 PRINT"■Your Attempt FAILED":EL=EL-Z/W:NL=NL-1:FA=1:RETURN
416 IFAC=2THENS=FNA(S):PRINT"■You Have Killed";S;EN$:RETURN
417 IFAC=1THENPRINT"■You Have TAKEN the ";LT$:RETURN
418 IFAC=3THENZ=INT(FNA(30)/W):S=INT(FNA(20)*W):PRINTME$;"Killed";S;
419 IFAC=3THENPRINTEN$;" and Lost";Z:EL=EL-Z:RETURN
420 IF(AC=4)*(RS=0)THENPRINT"NO RANSOM is Paid for ";EN$:RETURN
421 IFAC=4THENRETURN
422 IF(AC=5)*(MY>M*S)THENRETURN
423 IFAC=5THENPRINT"YOU HAVEN'T GOT MONEY FOR BRIBES":GOTO396
424 PRINT"DR.Ratok is broadcasting one of is 6    hour speaches about YOU.";
425 PRINT"The people blame YOU for having to put up with it":RETURN
426 DATA" John Kipinski"," Lopez"," Raoul Smith"," Gomez"
427 DATA" Stuffed Owl","n Old   Sock"
428 DATA" Copy of the Diaz Times"," Truss"
429 DATA"Gen.Jung is about to Visit the Hotel"," Knifes"
430 DATA"Capt.Le Shan is about to Visit the Hotel"," Hand Guns"
431 DATA" Lt.Lapidus WEARS TIGHTS"," Rifles"
432 DATA" Sgt.Sadoul HATES MICE"," Automatic Weapons"
433 DATA"CUBAN","RUSSIAN","PAPAL","SYRIAN","AMERICAN"
434 PRINTM$;"Meets an Arms Dealer with■■■■■Catalogue":FORA=0TO2000:NEXT
435 PRINT"■■■■■■■KHAGOSSHI GLOBAL ARMS SALES■■■■■■■■■■ Discount for 300+Guns"
436 HA=FNA(5)+5:RI=FNA(10)+10:DY=FNA(100)+100:RO=FNA(50)+50:PRINT
437 PRINT"■[1]";TW$(2);HA;" each■":PRINT" [2] Rifles";RI;" each■"
438 PRINT" [3] Dynamite";DY;"■":PRINT" [4] Rope";RO;"■"
439 SA$="■■SOLD":N$="■YOU CAN'T AFFORD IT":IF(HE>0)+(MY<3500)THEN442
440 PRINT"■[5] *SPECIAL OFFER* Ex-U.S.Army"
441 PRINT"        ■■Helicopter  (low Mileage)■"
442 PRINT"■[6] Nothing": PRINT"■ Which Item Would You Like to Buy■":GOSUB471
443 INPUTAB
444 IF(AB=1)*(MY=>HA*300)THENPRINTSA$:W=2:MY=MY-HA*300:GOTO396
445 IFAB=1THENPRINTN$:GOTO396
446 IF(AB=2)*(MY=>RI*300)THENPRINTSA$:W=3:MY=MY-RI*300:GOTO396
447 IFAB=2THENPRINTN$:GOTO396
448 IF(AB=3)*(MY=>DY)THENPRINTSA$:MY=MY-DY:DT=DT+1:GOTO396
449 IFAB=3THENPRINTN$:GOTO396
450 IF(AB=4)*(MY=>RO)THENPRINTSA$:MY=MY-RO:RP=RP+1:GOTO396
451 IFAB=4THENPRINTN$:GOTO396
452 IF(AB=5)*(MY=>3500)THENPRINTSA$:MY=MY-3500:HE=1:GOTO396
453 IFAB=5THENPRINTN$:GOTO396
454 GOTO66
455 PRINT"■■■■The Black Marketeer Offers"
456 IFFO>0THENM=FNA(500):SP$="Some Food":GOSUB462:IFA$="Y"THENFO=FO-1
457 IFRD=1THENM=FNA(1000):SP$="Your Radios":GOSUB462:IFA$="Y"THENRD=2
458 IFVR=1THENM=FNA(1500):SP$="Your Vidios":GOSUB462:IFA$="Y"THENVR=2
459 IFJP=1THENM=FNA(700):SP$="Your Jeep":GOSUB462:IFA$="Y"THENJP=2
460 IFGB=1THENM=FNA(2500):SP$="Your Gold Bar":GOSUB462:IFA$="Y"THENGB=2
461 GOTO396
462 PRINT"■■■";M;" Dollars for ";SP$
463 PRINT"■■■■What About It":GOSUB468
464 IFA$="Y"THENMY=MY+M:RETURN
465 RETURN
466 PRINTM$;"is Told That There Are";S
467 PRINTEN$;" in the Area. Will You Take      ACTION"
468 GETA$:IFA$=""THEN468
469 IF(A$="Y")+(A$="N")THENRETURN
470 PRINT"You Could Become BORING!! PRESS YorN":GOTO468
471 PRINT"■■■ • SELECT NUMBER THEN PRESS CR■•":RETURN
```

```
472 PRINT"           CITY of DIAZ  "
473 PRINT"  -N-                        "
474 PRINT"                         I.N"
475 PRINT"                            "
476 PRINT" Ocean          Police  1"
477 PRINT"          Church        1"
478 PRINT"     Palace             s"
479 PRINT"              Bank      "
480 PRINT"                        "
481 PRINT"              Hotel     "
482 PRINT"                        H"
483 PRINT"                        "
484 PRINT"   Barracks    T.V      1"
485 PRINT"                        1"
486 PRINT"               Stn      s"
487 PRINT"                        "
488 PRINT"    Prison              "
489 PRINT"                 Fort   "
490 PRINT"                        "
491 PRINT"                   Road"
492 PRINT"                   Fence"
493 PRINT"                   Tower"
494 PRINT"      Ghetto        ** Wall":IFMP=0THEN501
495 A=4465:B=4466:POKEB,1:POKEA,17:PRINTPT(5):POKEA,17:POKEB,10:PRINTPT(3)
496 POKEB,15:POKEA,17:PRINTPT(4):POKEB,18:POKEA,17:PRINTPT(6):POKEB,21
497 POKEA,17:PRINTPT(8):POKEB,10:POKEA,3:PRINTPT(1):POKEA,6:POKEB,15
498 PRINTPT(2):POKEA,6:POKEB,21:PRINTPT(7):POKEA,29:POKEB,3:PRINTPT(9)
499 POKEA,29:POKEB,7:PRINTPT(10):POKEA,33:POKEB,9:PRINTPT(11):POKEA,32
500 POKEB,16:PRINTPT(12):POKEA,24:POKEB,16:PRINTPT(13):MP=0:GOTO396
501 I(1)=402:I(2)=605:I(3)=416:I(4)=616:I(5)=56:I(6)=736:I(7)=845:I(8)=856
502 I(9)=148:I(10)=508:I(11)=392:I(12)=671:I(13)=663
503 FORA=1TO13:IFTR(A)=0THENPOKEX+I(A),107
504 NEXT:GOTO396
505 PRINT"                            "
506 PRINT"                            "
507 PRINT"              Hotel         "
508 PRINT"              DIAZ          "
509 PRINT"                            "
510 PRINT"                            "
511 PRINT"                            "
512 PRINT"                            "
513 PRINT"                            "
514 PRINT"                            "
515 PRINT"                            "
516 PRINT"                            "
517 PRINT"                            "
518 FORA=1TO400:NEXT:RETURN
519 PRINT"                            "
520 PRINT"                            "
521 PRINT"                            "
522 PRINT"                            "
523 PRINT"                            "
524 PRINT"                            "
525 PRINT"      TV-DIAZ-RADIO         "
526 PRINT"                            "
527 PRINT"                            "
528 PRINT"                            "
529 PRINT"                            "
530 PRINT"                            "
531 PRINT"                            "
532 PRINT"                            "
533 PRINT"                            "
534 PRINT"                            "
535 PRINT"                            "
536 PRINT"                            "
537 PRINT"                            ":IFTV>0THENPOKEX+220,208
538 FORA=1TO400:NEXT:RETURN
539 PRINT"                            "
540 PRINT"                            "
541 PRINT"                            "
542 PRINT"                            "
543 PRINT"                            "
544 PRINT"                            "
545 PRINT"                            "
546 PRINT"                            "
547 PRINT"                            "
548 PRINT"                            "
549 PRINT"                            "
550 PRINT"                            "
551 PRINT"                            "
552 PRINT"                            "
553 PRINT"                            "
554 PRINT"                            "
555 FORA=1TO400:NEXT:RETURN
556 PRINT"                            "
557 PRINT"                            "
558 PRINT"                            "
559 PRINT"                            "
560 PRINT"                            "
561 PRINT"                            "
562 PRINT"                            "
563 PRINT"                            "
564 PRINT"                            "
565 PRINT"                            "
566 PRINT"                            "
567 PRINT"                            "
568 PRINT"                            "
569 PRINT"                            "
570 PRINT"                            "
571 PRINT"                            "
572 PRINT"                            "
573 PRINT"                            "
574 FORA=1TO400:NEXT:RETURN
575 PRINT"                            "
576 PRINT"                            "
577 PRINT"                            "
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579 PRINT"                            "
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581 PRINT"                            "
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590 PRINT"                            "
591 PRINT"                            "
592 PRINT"                            "
593 PRINT"                            "
594 PRINT"                            "
595 PRINT"                            "
596 FORA=1TO400:NEXT:RETURN
597 PRINT"                            "
598 PRINT"                            "
599 PRINT"                            "
600 PRINT"                            "
601 PRINT"                            "
602 PRINT"                            "
603 PRINT"                            "
604 PRINT"                            "
605 PRINT"                            "
606 PRINT"                            "
607 PRINT"                            "
608 PRINT"                            "
609 PRINT"                            "
610 PRINT"                            "
611 PRINT"                            ":IFPR>0THENPOKEX+142,208
612 FORA=1TO400:NEXT:RETURN
613 PRINT"                            "
614 PRINT"                            "
615 PRINT"                            "
616 PRINT"                            "
617 PRINT"                            "
618 PRINT"                            "
619 PRINT"                            "
620 PRINT"                            "
621 PRINT"                            "
622 PRINT"                            "
623 PRINT"                            "
624 PRINT"                            "
625 PRINT"                            "
626 PRINT"                            "
627 PRINT"                            "
628 PRINT"                            "
629 PRINT"                            "
630 PRINT"                            "
631 PRINT"                            "
632 PRINT"                            "
633 PRINT"                            "
634 PRINT"                            "
635 FORA=1TO400:NEXT:RETURN
636 PRINT"                            "
637 PRINT"                            "
638 PRINT"                            "
639 PRINT"                            "
640 PRINT"                            "
641 PRINT"                            "
642 PRINT"                            "
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647 PRINT"                            "
648 PRINT"                            "
649 PRINT"                            "
650 PRINT"                            "
651 PRINT"                            "
652 PRINT"                            "
653 PRINT"                            "
654 PRINT"                            "
655 PRINT"                            "
656 PRINT"                            "
657 PRINT"                            "
658 PRINT"                            "
659 PRINT"                            "
660 FORA=1TO400:NEXT:RETURN
661 PRINT"                            "
662 PRINT"                            "
663 PRINT"                            "
664 PRINT"                            "
665 PRINT"            POLIS           "
666 PRINT"                            "
667 PRINT"                            "
668 PRINT"                            "
669 PRINT"                            "
670 PRINT"                            "
671 PRINT"                            "
672 PRINT"                            "
673 PRINT"                            "
674 PRINT"                            "
675 PRINT"                            "
676 PRINT"                            "
677 PRINT"                            "
678 PRINT"                            ":IFPH>0THENPOKEX+180,208
679 FORA=1TO400:NEXT:RETURN
680 PRINT"                            "
681 PRINT"                            "
682 PRINT"                            "
683 PRINT"                            "
684 PRINT"                            "
685 PRINT"                            "
686 PRINT"                            "
687 PRINT"     Bank de DIAZ           "
688 PRINT"                            "
689 PRINT"                            "
690 PRINT"                            "
691 PRINT"                            "
692 PRINT"                            "
693 PRINT"                            "
694 PRINT"                            "
695 PRINT"                            "
696 PRINT"                            "
697 PRINT"                            "
698 PRINT"                            "
699 FORA=1TO400:NEXT:RETURN
700 PRINT"                            "
701 PRINT"                            "
702 PRINT"                            "
703 PRINT"                            "
704 PRINT"                            "
705 PRINT"                            "
706 PRINT"                            "
707 PRINT"                            "
708 PRINT"                            "
709 PRINT" SONY T.V    Hernandez   Cafe "
710 PRINT"             Cantina          "
711 PRINT" Lopez Bros                   "
712 PRINT"                            "
713 PRINT"                            "
714 PRINT"                            "
715 PRINT"                            "
716 PRINT"                            "
717 PRINT"                            "
718 PRINT"                            "
719 PRINT"                            "
720 PRINT"                            "
721 FORA=1TO400:NEXT:RETURN
722 PRINT"                            "
723 PRINT"                            "
724 PRINT"                            "
725 PRINT"                            "
726 PRINT"                            "
727 PRINT"                            "
728 PRINT"                            "
729 PRINT"                            "
730 PRINT"                            "
731 PRINT"                            "
732 PRINT"                            "
733 PRINT"                            "
734 PRINT"                            "
735 PRINT"                            "
736 PRINT"                            "
737 PRINT"                            "
738 PRINT"                            "
739 PRINT"                            "
740 PRINT"                            "
741 PRINT"                            "
742 PRINT"                            ":IFBT>0THENPOKEX+85,208
743 FORA=1TO400:NEXT:RETURN
744 PRINT"CONGRATULATIONS!!!"
745 PRINT"President for Life DR.Emmanuel Raton has Resigned After";MV;
746 PRINT" Moves":PRINT"FANCY THE JOB ?":GOTO763
747 PRINT"FAILURE!!!"
748 PRINT"After";MV;" MovesYou Have Been Arrested"
749 PRINT"having Captured:"
750 IF(BT=0)*(PR=0)*(TV=0)*(PH=0)*(BA=0)THENPRINT"NOTHING":GOTO754
751 IFBT>0THENPRINT"The Barracks"
752 IFPR>0THENPRINT"The Prison"
753 IFTV>0THENPRINT"The T.V.Station"
754 IFPH>0THENPRINT"The Police Station"
755 IFBA>0THENPRINT"The Bank"
756 PRINT"                            "
757 PRINT"                            "
758 PRINT"                            "
759 FORD=0TO800:NEXT
760 TEMPO7:MUSIC"G1      "
761 PRINT"                            "
762 TEMPO6:MUSIC"CAR2C4R1C4R1C6R1#D4R1D4R1D4R1C4R1C4_D4R1C6":END
763 A$="                  "
764 B$="                                   "
765 Y=0
766 PRINT"                  "
767 Y=Y+1
768 C$=LEFT$(B$,Y)
769 X$=" />     /                             "
770 R$="                 "
771 F$=" />     /                             "
772 PRINTA$;C$;F$
773 TEMPO7:MUSIC"A3R03"
774 POKE53248+486+Y,167
775 IFY=17THEN777
776 GOTO767
777 PRINTA$;C$;X$;R$;USR(62)
778 FORA=0TO1000:NEXT
779 Y=Y+1
780 C$=LEFT$(B$,Y)
781 PRINTA$;C$;X$:TEMPO7:MUSIC"A0R80"
782 IFY=30THENEND
783 GOTO779
784 IFDT>0THENPRINTDT;" Stick(s) of Dynamite":PRINT
785 IFRP>0THENPRINTRP;" Rope(s)":PRINT
786 IFBO=1THENPRINT" A Boat":PRINT
787 IFHE=1THENPRINT" An Helicopter";:IFHD=1THENPRINT"(Slightly Damaged)";
788 PRINT" ":PRINT
789 IFHS>0THENPRINTHS;" Hostage(s)":PRINT
790 IFGB=1THENPRINT" A Gold Bar":PRINT
791 IFJP=1THENPRINT" A Jeep":PRINT
792 IFVR=1THENPRINT" Video Recorders":PRINT
793 IFRD=1" Radio's":PRINT
794 IFFD>0THENPRINTFD;" Food Box(s)"
795 IF(DT>0)+(RP>0)+(BO>0)+(HE>0)+(HS>0)+(GB>0)+(JP>0)+(VR>0)+(RD>0)THEN396
796 PRINT"Your Not Doing Very Well,ARE YOU ?":GOTO396
797 GOSUB800:PRINTM$;"is SHOT By the Opposition":Y=FNA(2)
798 IFY=1THENPRINT"OUCH!Painful But Not Fatal":GOTO396
799 PRINT"Another Martyr For the Cause":NL=NL-1:GOTO396
800 TEMPO7:FORA=0TO10:MUSIC"GR1":NEXT:RETURN
801 FORA=0TO5:TEMPO3:MUSIC"G1_F1_":NEXT:RETURN
```

```
0001 REM "PROBE"
0002 PRINT AT 10,10;"""PROBE"""
0003 PRINT AT 12,10;"BY B.R.LAW."
0004 PRINT AT 14,10;"22/1/82"
0005 PRINT AT 19,0;"DO YOU WANT
A BEGINERS GAME Y/N?"
0006 INPUT I$
0007 CLS
0009 FAST
0010 DIM H$(7,3)
0011 DIM F(7)
0012 DIM K(7)
0013 DIM C(7)
0014 DIM L(7)
0015 DIM H(7)
0016 DIM P(7)
0017 DIM P$(7,3)
0019 DIM M$(7,4)
0020 LET P$(1)="[graphics]"
0025 LET P$(2)="[graphics]"
0030 LET P$(3)="[graphics]"
0035 LET P$(4)="[graphics]"
0040 LET P$(5)="[graphics]"
0045 LET P$(6)="[graphics]"
0050 LET P$(7)="[graphics]"
0060 LET M$(1)="[graphics]"
0065 LET M$(2)="[graphics]"
0070 LET M$(3)="[graphics]"
0075 LET M$(4)="[graphics]"
0080 LET M$(5)="[graphics]"
0085 LET M$(6)="[graphics]"
0090 LET M$(7)="[graphics]"
0100 LET H$(1)="[graphics]"
0110 LET H$(2)="[graphics]"
0120 LET H$(3)="[graphics]"
0130 LET H$(4)="[graphics]"
0140 LET H$(5)="[graphics]"
0150 LET H$(6)="[graphics]"
0160 LET H$(7)="[graphics]"
0170 FOR H=1 TO 7
0180 LET H(H)=H
0190 NEXT H
0195 REM SHUFFLE LOCKS
0200 FOR H=1 TO 7
0210 LET R=INT (RND*7+1)
0220 LET X=H(R)
0230 LET H(R)=H(H)
0240 LET H(H)=X
0250 NEXT H
0252 GOSUB 1000
0253 IF I$="Y" THEN GOTO 490
0254 REM PRINT GRID OVER LOCKS"
0255 FOR H=1 TO 7
0260 PRINT AT 9,(H*4)-2;"▒▒▒";
0270 NEXT H
0490 SLOW
0495 REM INPUT KEY AND LOCK NUMBERS
0500 PRINT AT 21,0;"K? "
0510 INPUT P
0515 PRINT AT 21,0;"L?"
0520 INPUT H
0522 REM LOGIC GATE
0525 IF P(H)<>0 THEN GOTO 500
0530 IF H(H)=1 AND P=1 THEN GOTO 62
0
0540 IF H(H)=2 AND P=2 THEN GOTO 62
```

GAMES SPECIAL

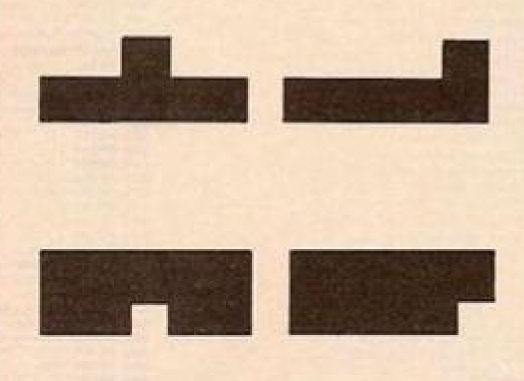


Figure 1. Top line shows two of the keys, bottom line shows two of the locks.

PROBE IS A game program for the ZX-81 with 16K RAM that requires equal measures of luck and skill for it to be completed in the minimum number of moves. The essence of the game is to fit seven keys, which are all different, into the correct locks in the minimum number of moves.

The game is original, and was first developed as a board game to rival the popular game of Mastermind. In its original form the keys consisted of a combination of pins mounted on a shaft, which were tried at various positions on the board to penetrate the locks which consisted of plates with holes in designed to fit specific keys. Its advantage over Mastermind is its self-scoring ability, that is, a passive opponent is not required to report the success or failure of each move.

A second version of the board game was also devised so that a second player could actively participate. This version had locks on the opponent's side of the board that were the reciprocal of the player's own locks. Unfortunately the screen size on the ZX-81 is too small for this second version of the game.

The basis of ZX-81 Probe is that a key with up to three pins on it, can have a possible seven combinations.

If we have seven keys we only need seven locks to complete the elements of a board game.

If it is imagined that the keys are pins and that the locks are holes, it will be seen that most keys will fit into more than one lock, as

C(H)	A counter used to locate the printing of copies of the key above the lock when it has fitted.
K(H)	A counter used to locate the printing of copies of the key below the lock when it was tried and failed to fit.
F(P)	Flag to indicate whether a particular key P has been placed on the board.
H(H)	The number of the lock in position H.
P(H)	The number of the key in position H.
L(P)	The last location of key P.
H	The lock position.
P	The key position.

Variables used.

FIND T

The object of this game is to fit seven keys in seven locks in as few goes as possible. How good a cracksman are you?

shown in figure 2. However, if all the keys are to be fitted, the correct key must be found for each lock.

The object of the game, therefore, is to fit each key into its correct lock. The game is initially set up on the screen like this. First, the keys are set out in sequence along the bottom of the screen and each one is numbered from 1 to 7. Next, the locks are shuffled by the computer, layed out across the centre of the screen, and then covered by a grid or shield so that the player cannot see the sequence. The beginner's game leaves the shield off.

A prompt — K? — appears at the bottom left-hand corner of the screen, asking for the number of the key to be played.

This is followed by a prompt asking which

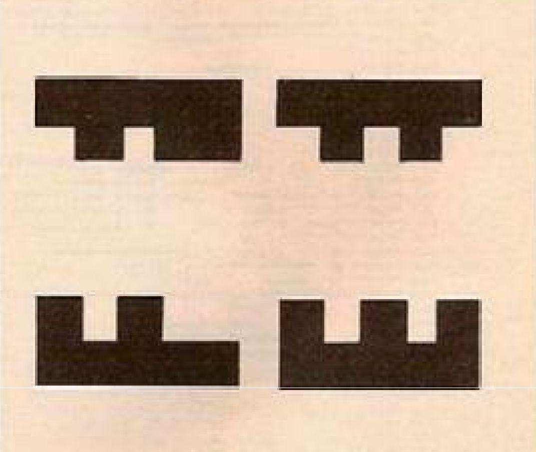


Figure 2. As you can see, some keys would fit more than one lock.

lock the key is to be tried in — L?. If the key fits — and remember it need not necessarily be the correct fit — the display will change as shown in figure 3.

If a key does not fit, the key stays put.

Several moves later you may conceivably get to the stage where, say, key 2 has been fitted into lock 1 and key 3 into lock 6. Key 4 has failed to fit in any of the remaining unoccupied locks.

To find a home for key 4 it is necessary to move one of the other keys which must be occupying key 4's proper lock. The best chance of fitting key 4 is to try locks 1 or 6. Let us therefore try it in lock 1. To do this we must first move key 2 somewhere else, say lock 7. Therefore input:

K? 2 L? 7

This fits and therefore leaves lock 1 free to try key 4 in it. Therefore input:

K? 4 L? 1

The game continues in this manner until all seven keys have been housed. When this point

THE KEY TO ZX PROBE

is reached your score is printed at the top of screen; the lower score the better.

You cannot place a key into a lock that is already occupied. Keys always retain the number they are given at the start of the game, they do not adopt the number of the lock they are fitted into.

A key must always have a home either at the bottom of the board or in the board, it cannot be pulled out of a lock and left out, it must find a new lock to fit into before vacating its current position.

As for the program itself, lines 20 to 160 put the key, mask and lock shapes into their respective strings. Lines 170 to 190 allocate a position to each of the locks before they are shuffled by lines 200 to 250 into a random sequence. After shuffling they are sent off for the printing of the board, and all the keys, locks and key numbers.

Line 253 jumps the printing of the screen over the locks if the beginner's game is being played. Lines 500 to 520 ask you to enter the number of the key to be moved and the number of the lock it is to be tried in. Line 525 stops you trying to fit a key into a lock that is already occupied.

Lines 530 to 590 are a logic gate and judge the compatibility of key and lock. If they are compatible then you jump to line 620. Lines 600 and 610 are used, if the key and lock are not compatible in which case a counter K(H) is incremented by two so that the not-fit marker is printed in the correct position.

Line 620 increments the fit marker for printing. Line 630 checks the flag F(P) to see if the key P has previously been fitted. If it has, a different print routine has to be used. Line

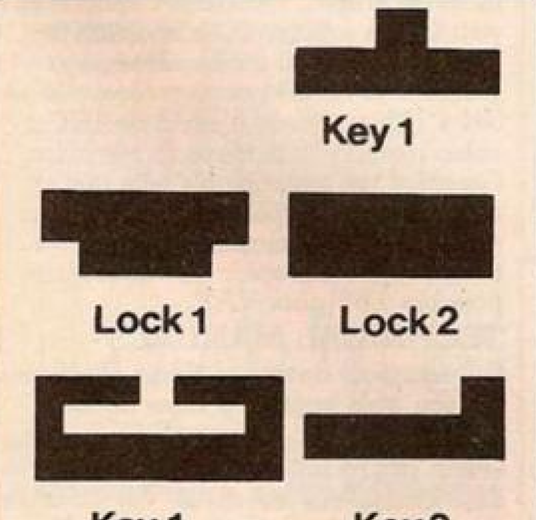
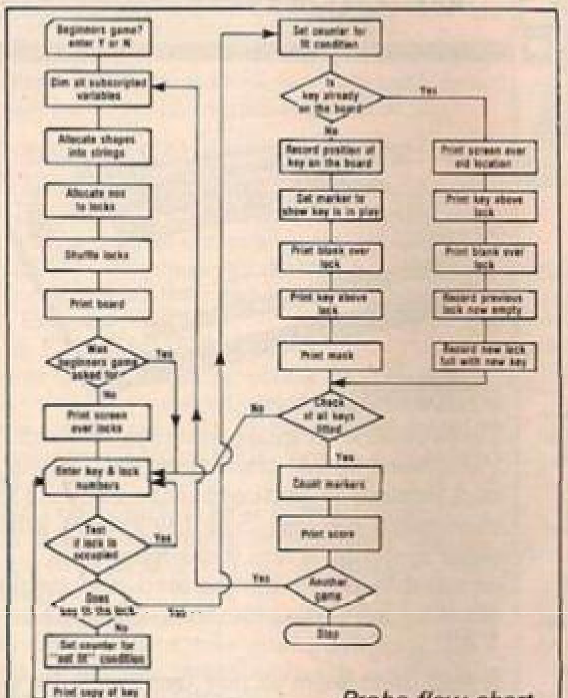


Figure 3. Key 1 is shown above lock 2 which is blanked off to show that a key has been fitted.



Probe flow chart.

640 sets the variable L(P) equal to the board position for key P.

Line 650 sets the flag F(P) equal to 1 for key P showing that from now on that key is in play. Lines 1010 to 1050 print the locks, keys and key numbers. Lines 1100 to 1125 are used when a key has been fitted. Line 1105 prints a solid blank over the lock to show that it is now occupied.

Line 1110 prints the key over the lock using counter C(H). Lines 1120 and 1125 print a mask in lace of the key that was at the bottom of the board. Line 1130 sends off for checking to see if all the keys have been fitted.

Lines 1200 to 1220 are used when a key was tried and failed to fit, in this case line 1210 prints a copy of the key below the locks to show that it was tried and failed. Lines 1300 to 1337 are used when a key is moved and fits into another lock on the board. Line 1310 prints a screen over the vacated lock to show that it is now empty.

Line 1320 prints the key above the new lock. Line 1330 prints a solid blank over the new lock to show that it is occupied. Line 1335 sets the variable P(L(P)) to 0 indicating that no key is fitted in that location.

Line 1337 sets the variable L(P) to the value of key P. Line 1500 to 1515 tests to see if all the locks are occupied. Line 1502 is used to up date P(H) with its new key. Lines 1505 to 1515 checks each lock in turn.

Lines 1517 onwards count the number of goes taken by adding up the counters C( ) and K( ) and dividing by two. Remember the counters are increased by two each time. ■

```
0
0550 IF H(H)=3 AND P=3 THEN  GOTO 62
0
0560 IF H(H)=4 AND P=2 OR H(H)=4
 AND P=3 OR H(H)=4 AND P=4 THEN
 GOTO 620
0570 IF H(H)=5 AND P=1 OR H(H)=5
 AND P=2 OR H(H)=5 AND P=5 THEN
 GOTO 620
0580 IF H(H)=6 AND P=1 OR H(H)=6
 AND P=3 OR H(H)=6 AND P=6 THEN
 GOTO 620
0590 IF H(H)=7 THEN  GOTO 620
0595 REM NOT COMPATIBLE
0600 LET  K(H)=K(H)+2
0610 GOTO 1200
0615 REM COMPATIBLE
0620 LET  C(H)=C(H)+2
0630 IF F(P)=1 THEN  GOTO 1300
0640 LET  L(P)=H
0650 LET  F(P)=1
0660 GOTO 1100
1000 REM INITIAL BOARD DISPLAY
1010 FOR X=1 TO 7
1020 PRINT AT 9,(X*4)-2;H$(H(X))
1030 PRINT AT 19,(X*4)-2;P$(X)
1040 PRINT AT 21,(X*4)-1;X
1050 NEXT X
1060 RETURN
1100 REM KEY FITTED CORRECT
1105 PRINT AT 9,(H*4)-2;"███"
1110 PRINT AT 9-C(H),(H*4)-2;P$(P)
1120 PRINT AT 19,-2+(P*4);M$(P)
1125 PRINT AT 20,-2+(P*4);"▀▀▀"
1130 GOTO 1500
1200 REM KEY FITTED INCORRECT
1210 PRINT AT 9+K(H),(H*4)-2;P$(P)
1220 GOTO 500
1310 PRINT AT 9,(L(P)*4)-2;"▒▒▒"
1320 PRINT AT 9-C(H),(H*4)-2;P$(P)
1330 PRINT AT 9,(H*4)-2;"███"
1335 LET  P(L(P))=0
1337 LET  L(P)=H
1340 GOTO 1500
1500 REM TEST TO SEE IF ALL
LOCATIONS ARE FILLED
1502 LET  P(H)=P
1505 FOR H=1 TO 7
1510 IF P(H)<>H(H) THEN  GOTO 500
1515 NEXT H
1517 REM ADD UP THE NUMBER OF GOES
TAKEN
1520 LET  S=0
1530 FOR X=1 TO 7
1540 LET  S=S+C(X)/2+K(X)/2
1550 NEXT X
1560 PRINT AT 0,0;"SCORE ";S;" ANOTH
ER GO Y/N?"
1570 INPUT G$
1575 LET  I$="N"
1580 IF G$="Y" THEN  GOTO Z
1590 STOP
2000 SAVE "PROBE"
2001 GOTO 1
```

Why not spend Christmas with the Genie Family!

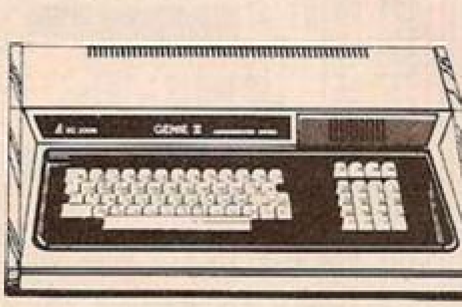


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The EG 3085 is quiet, fast and efficient. Printspeed is 100 characters per second and printing is bi-directional at 80 or 136 characters per line. Suitable for use with other systems, it has three typestyles, adjustable pin or friction feed and single sheet or roll paper facilities. **£425 plus VAT.**

If you don't want to pay that much for a printer, consider the EG 603. It doesn't match the EG 3085 in certain areas, but you will still get 100 c.p.s. bi-directional, a range of character styles, forward and reverse feed and pin/friction feed, with 96 characters and 64 graphic patterns. **£235 plus VAT**



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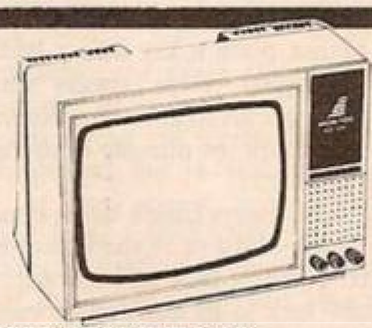
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Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black leather covers.

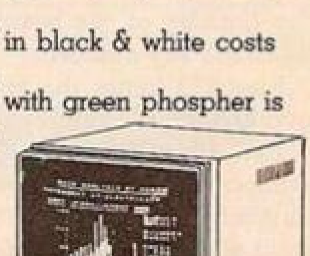
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Available in 9" and 12" sizes, with white, green or amber display, Lowe A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. **From £75 plus VAT.**

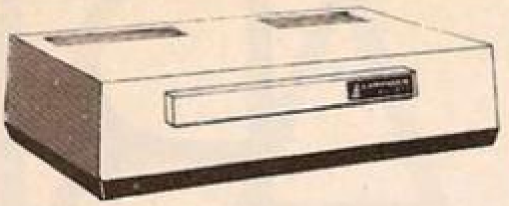
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Increase graphic resolution capabilities on your Genie seventy-three fold with the LE18 HI-RES unit. It offers bit image graphics of 73,728 points, a resolution of 384 x 192, and uses a separate 16K of video memory to achieve its resolution. Graphics are intermixable with text or existing pixtel graphics, and animation, reverse video displays and use of programmable graphic characters are possible. **£86 plus VAT.**

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Full technical details of Genie Hardware (all you ever wanted to know about Genie).

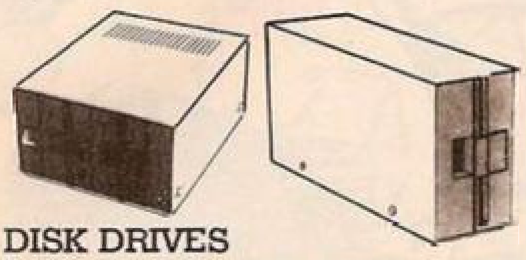
Genie I/II Technical Manual
£10 - No VAT.
Expander and accessories (EG3014)
£10 - No VAT.



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The updated EG 3014 expander box allows for up to four disk drives with optional double density. It connects to a printer, or RS 232 interface, or S100 cards. Not bad value at **£190 plus VAT (16K version) or £200 plus VAT (32K version)**

*The EG 3014 will work with TRS 80 by using the EG 3023 Tandy Adaptor.



DISK DRIVES

If you want fast, reliable program storage, true random access file handling and access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested, in a stylish colour matched cabinet. **£220 plus VAT.**

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DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double the storage capacity. The EG 3021 is equally at home in the Genie or TRS-80 expander boxes.

A double density disk operating system will be needed, such as smalLDOS provides. **£72 plus VAT.**

smalLDOS

Powerful, yet reasonably priced, the Genie smalLDOS contains 21 library commands, 7 utilities, LBASIC, disk basic and bags of information, including a reference manual and 40 page beginners guide to disk usage. **£35 plus VAT.**

BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL. Each package is a very reasonable **£175** plus VAT. Full details on request.

EG 3203 TANDY-BASHER

If you are a TANDY user, read on! The EG 3203 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. **£18.40** plus VAT.

(Just in case there might be a few strange souls who want to convert in the opposite direction, there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie.) **£34** plus VAT.

FRED MUSIC SYNTHESISER

Beethoven might well roll over at this stereo music synthesiser, it can produce six simultaneous notes over the whole audio range and provide sound effects. FRED comes complete with a software compiler, full instructions and a demo tune. It is simply plugged onto the Genie 50 way bus and has two outputs for an audio amplifier. **£51** plus VAT.

EG 3016 PARALLEL PRINTER INTERFACE

The EG 3016 is a simpler interface allowing a Centronics parallel compatible printer (EG 603, EG 3085) to be connected directly to the Genie keyboard without the need for an expander box. **£38** plus VAT.

BUS EXTENDER

A most useful accessory, allows two bus using devices to be connected simultaneously to the Genie – when using the Hi Res and expander for instance. **£21** plus VAT.

EP1, EP3

Genie I and Genie II have ROMS offering 13.5K BASIC are custom written extensions contained in EPROMs. You can change these as follows:

EP1 Adds all Genie 1 software facilities to other Genies, lower case driver, machine language monitor, renumber facility, keyboard repeat and screen print.

EP3 Has HI-RES driver software with 10 extra HI-RES commands which prevent need to load HI-RES software from tape. All at **£12** plus VAT.

For Video Genie Systems, the LE-19 connects direct to the Genie bus and allows one of these EPROMs to be fitted externally. **£26.50** plus VAT.

SYSTEMS DESK



Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. **£81.40** plus VAT.

SPECIAL TECHNICAL GENIE HOT – LINE ON 0629 4995

for all your technical advice and service back-up on any aspect of the Genie system direct from the experts



Colour Genie is the latest piece of personal computer magic from Lowe Electronics. Remarkably compact in design, Colour Genie is a powerful piece of new technology which combines all the best features of the popular Genie I; 16K RAM, 16K BASIC ROM, and full size typewriter keyboard, with the addition of vivid colour, high resolution graphics, 3 channel sound and 40 x 24 screen format – a new dimension in home computing!

Put one in your living room, connect it to a standard colour T.V., and you will be amazed at the worlds that open up for you and your family!

For children and adults, Colour Genie provides an ideal introduction to computer programming. If you fancy a spot of intergalactic travel, or a battle for the planets, Genie will lay on the transport. When you get tired of the kids beating you at Space Invaders, you can always turn their attention to schoolwork. Genie makes that fun too! You can learn typing, a foreign language, or simply keep your household accounts in order.

Of course, Colour Genie is only one of a number of home computers you could consider buying; however, the £199 price tag gets rid of some of the opposition, as do the 64 present and 128 programmable graphic characters! 8 exciting colours leave a few more standing, and four function keys with a built in power supply put Colour Genie way out in front!

ACCESSORIES

Colour Genie can be supplemented by a large range of optional extras. There is an attractive matching cassette recorder on which to store your own programs, or play pre-recorded software. Joysticks are available for popular video games, and a position-detecting light pen to heighten your colour-graphic creations. If you want to put your machine to work in your business, it can be expanded by a 16K RAM card, and connected to a quality matrix printer via the printer interface and cable.

SOFTWARE

Colour Genie uses a Z80 central processing unit, and is fully programmable in Microsoft colour BASIC, the most popular home computer language in the Western World!

MUSIC

Colour Genie contains a FULL MUSIC SYNTHESISER, which will generate a remarkable range of musical sounds through your T.V. speaker, in a variety of pre-settable tempos.

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YC.12.82

GAMES SPECIAL

BR

You have to stay on the ball if you want to break through to higher scores in John Cullen's Vic-20 version of the famous arcade game.



IN THIS VERSION of Breakout, a machine-code subroutine has been used to move the bat. The mnemonics for the machine code are included so that if anybody wants to convert the game, they should be able to. Peeks and Pokes are all explained in this program.

The screen starts at location 7680 and finishes at 8185. The top right corner is 7701, and the bottom left corner is 8164. The colour memory map starts at 38400 and goes on to 38906. The top right location is 38421 and the bottom left location is 38884.

If any other Vic owners have memory expansion above the 3K RAM from Commodore, then they will know that the screen relocates to 4096. This means that using the character generator is not possible. To overcome this you must type the following:

```
POKE 648,30:POKE 642,32:POKE 36869,240:
POKE 36866,150:POKE 0,108:POKE 1,0:
POKE 2,192:SYS(0)
```

This relocates the screen to 7680, and Basic starts above it. This leaves the space from 4096 to 7679 free for the character generator. SYS58276 resets all variables including the memory pointers without altering the program.

In line 1, Gosub 4200 initialises the machine code: 0 and 1, the free locations in the zero page, contain the value of the key pressed. Location 673 contains a routine which checks for all the bricks gone. At 674 is the last position of the bat. The 675, 676 Pokes indicate the key pressed — 675 for Z key, 676 for C key. Peek (197) returns value of key pressed.

In line 2, R1 to R4 are screen control registers. The S3 designates voice number 3, V is for volume. In line 5, V + 1 sets screen and border colour to orange and red. The sixth line's T(I) colours the layers of bricks: it can be altered for random colours. Goto 2000: this is the start of instructions.

In line 10, Y gives the vertical position of the ball; DY gives direction, that is, -1 is up, 1 is down, SC is score and HI is high score. In line 11, SC is reset. The level prompt indicates the number of bats; level 1 is one bat and level 4 is four bats. A null input sets the level to 4. At line 12, C is the counter for the number of bats used. The top left-hand corner of the screen is 7680. Character 224 is a reversed space, that is 96 + 128. The border around the screen is dealt with in 13. A reverse graphic is indicated by 208. A% is used for random colour. Location 38400 is the first colour location on the screen. Graphic 207 is a reverse space.

In line 15, 8164 is the bottom left-hand location of the screen. The corresponding colour memory map is given by 38884. In line 19, the loop I determines how many layers of bricks and their position; in this case five layers starting four lines down from the top of the screen. The loop J determines how many bricks in each line, in this case 20. At line 30, the graphic character 204 is a reversed space. In line 75, X is the horizontal position of the ball — graphic 81 — and Y is the vertical position. The Y value is multiplied by 22, because the screen is 22 characters wide.

In line 110, SYS 680 calls the machine-code subroutine to check which key, if any, has been pressed, and if so, move the bat. Line 180 rubs out the ball. The lines from 190 to 220 work out the new position of the ball; line 200 checks if the ball is at either side of the screen, and if so, reverses direction. Line 220 checks whether or not you have missed the ball. Line 230 checks new position to see if it is occupied by a brick. Line 240 checks if the ball has hit the bat or got to the top of the screen. Line 250 turns off the sound. Line 255 checks to see if all the bricks have gone with SYS 736, the second machine-code routine. If all the bricks have gone, then location 673 will contain 1, otherwise a 0. Line 260 calls machine code to move the bat. The speed of the bat is controlled by the number of SYS 680 commands between lines 75 and 260. Line 300 controls sound effects if the ball is missed.

```
LDY# $02A2
LDA# 32
STA($1FCD),Y
STA($1FCE),Y
STA($1FCF),Y
LDX# 00
LDA(I),X
CMP$0A3
BNE A
CPY# 02
BEQ A
DEY
LDA(I),X
CMP$02A4
BNE B
CPY# 19
BEQ B
INY
LDA# 224
STA($1FCD),Y
STA($1FCE),Y
STA($1FCF),Y
STY$02A2
RTS
LDX# 00
LDA($1E00),X
CMP# 204
BEQ A
INX
CPX# 255
BNE B
LDA# 01
STA$02A1
RTS
```

NB: Numbers after the hash are decimal

Mnemonics for the machine code.

REAKOUT



Line 310 takes one off the counter and if you still have a bat, Resets direction counters Y and DY, X and DX. Line 320 gives control to line 465, when all the bats are gone. Lines 400 to 418 control the display if you get all the bricks. The registers R1 to R4 are used here, to give a display. P% is the extra bonus you get, depending on level and final score. Line 470 clears the input buffer — 198 — and lines 471 and 472 check your answer to the prompt.

Line 1000 generates random X and DX values. If DX equals -1, ball goes left, if DX equals 1, the ball goes right. The instructions are at lines 2000 to 2085. Line 3000 calculates the score per brick and can be altered to give different values as wanted. Data containing machine-code routines in hexadecimal are contained in lines 4000 to 4015. Lines 4200 to 4265 are the Basic loader for machine code. Machine code is stored in free memory locations from 680 to 755. Locations 673 to 767 can be used to hold short machine-code routines. ■

```
1 GOSUB4200:POKE0,197:POKE1,0:POKE673,0:POKE674,10:POKE675,33:POKE676,34
2 XX$="":R1=36864:R2=R1+1:R3=R2+1:R4=R3+1:S3=36876:V=S3+2:S2=S3-1
5 PRINT"":POKEV+1,138
6 FORI=3TO7:T(I)=I:NEXT:GOTO2000
10 POKEV+1,138:POKEV,15:Y=20:DY=-1:GOSUB1000:PRINT"":IFSC>HITHENHI=SC
11 SC=0:INPUT"LEVEL";L:IFL<1ORL>4THENL=4
12 C=L:PRINT"":FORI=7680+22*2TO7680+22*2+21:POKEI,224:NEXT
13 FORI=3TO22:POKE7680+22*I,208:A%=RND(1)*7+1:POKE38400+22*I,A%:POKE7701+22*I,2
07
14 POKE38421+I*22,A%:NEXT
15 FORI=0TO21:POKE8164+I,207:A%=RND(1)*7+1:POKE38884+I,A%:NEXT
19 FORI=3TO7:FORJ=1TO20
30 POKE7680+22*I+J,204:POKE38400+22*I+J,T(I):NEXTJ,I
75 POKE7680+X+22*Y,81
80 PRINT"SCORE:"SC:PRINT"HI:"HI"CHANCES"C
110 SYS680
180 POKE7680+X+22*Y,32
190 X=X+DX
200 IFX<2ORX>19THENDX=-DX:POKES3,220
210 Y=Y+DY
220 IFY=22THEN300
230 IFPEEK(7658+X+22*Y)=204THENDY=1:POKES3,230:POKE7658+X+22*Y,32:GOSUB3000
240 IFPEEK(7702+X+22*Y)=224ORPEEK(7658+X+22*Y)=224THENDY=-DY:POKES3,240
250 POKES3,0
255 IFSC>190THENSYS736:IFPEEK(673)=1THEN400
260 SYS680:GOTO75
300 POKEV,15:FORI=230TO160STEP-.15:POKES2-1,I:NEXT:POKES2-1,0
310 C=C-1:IFC>0THENY=20:DY=-1:GOSUB1000:GOTO75
320 GOTO465
400 PRINT"":POKEV+1,27:FORI=160TO240STEP.5:POKES3,I:A%=RND(1)*505+1
405 POKE7680+A%,160:POKE38400+A%,INT(RND(1)*7)+1
410 NEXT:POKES3,0:P%=(SC/(L*3)+.5):I=0:J=0
412 J=J+1:FORI=0TO22:POKER1,12+I:POKER2,38+I:POKER3,150-I:POKER4,174-I*2:POKES3
,220+I
413 NEXT
414 FORI=22TO0STEP-1:POKER1,12+I:POKER2,38+I:POKER3,150-I:POKER4,174-I*2:POKES3
,220+I
415 NEXT:IFJ<5THEN412
417 POKES3,0:PRINT"YOU GET A BONUS OF"P%"SO YOUR SCORE IS"SC+P%:SC=SC+P%
418 FORI=0TO4000:NEXT
450 PRINT"CONGRATULATIONS YOU'VE  MADE IT.YOUR SCORE  WAS"SC"."
452 IFSC>HITHENPRINT"YOUR SCORE IS THE BEST SO FAR.WELL DONE!!!"
455 GOTO470
465 PRINT"CHANCES"C:POKES3,0:POKES2,0
470 POKE198,0:PRINTXX$"  ANOTHER GO(Y/N)";
471 INPUTAN$:IFLEFT$(AN$,1)<>"Y"ANDLEFT$(AN$,1)<>"N"THEN500
472 IFLEFT$(AN$,1)="Y"THEN10
474 PRINT"BYE FOR NOW THEN!!!!!!":END
500 PRINT"  I SAID Y OR N.....   OR ARE YOU BLIND?!!?"
505 FORTT=1TO4000:NEXT
507 GOTO471
1000 X=INT(RND(1)*20)+1:IFX<2ORX>19THEN1000
1010 DX=INT(RND(1)*3)-1:IFDX=0THEN1010
1030 RETURN
2000 PRINT" THIS IS BREAKOUT BY   JOHN CULLEN.TO PLAY   YOU MUST ";
2010 PRINT"KNOCK ALL    THE BRICKS FROM THE    WALL.EACH LAYER OF    BRICKS "

2020 PRINT"SCORES MORE    POINTS THAN THE LAST."
2030 PRINT"      HIT ANY KEY"
2031 GETA$:IFA$=""THEN2031
2032 PRINT" THE SCOREING SYSTEM  IS AS FOLLOWS:-  "
2035 PRINT" EACH LAYER OF BRICKS  SCORES POINTS "
2036 PRINT"LAYER 1:- 2 POINTS  LAYER 3:--4 POINTS   LAYER 5:--6 POINTS"
2038 PRINT"USE KEYS:-              Z - LEFT C - RIGHT"
2058 PRINT"      HIT ANY KEY"
2060 GETA$:IFA$=""THEN2060
2070 PRINT" BEFORE YOU START,YOU  WILL BE ASKED WHICH   LEVEL YOU WANT."
2071 PRINT" THE LEVEL INDICATES   THE NUMBER OF BATS   YOU GET:-"
2072 PRINT"LEVEL 1- ONE BAT..... LEVEL 2- TWO BATS.... ETC."
2075 PRINT" HIT ANY KEY TO START"
2080 GETA$:IFA$=""THEN2080
2085 GOTO10
3000 SC=SC+(10-Y):RETURN
4000 DATAAC,A2,02,A9,20,99,CD,1F,99,CE,1F,99,CF,1F,A2,00,A1,00,CD,A3,02,D0,07
4005 DATAC0,02,F0,03,88,A1,00,CD,A4,02,D0,05,C0,13,F0,01,C8,A9,E0,99,CD,1F,99
4010 DATACE,1F,99,CF,1F,8C,A2,02,60,YY,A2,00,BD,00,1E,C9,CC,F0,0A,E8,E0,FF,D0,F
4,A9,01
4015 DATA8D,A1,02,60,YY
4200 I=I+1:READA$:IFA$="YY"THENI=0:GOTO4250
4205 A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48:IFA>16THENA=A-7
4210 IFB>16THENB=B-7
4215 POKE679+I,A*16+B:GOTO4200
4250 I=I+1:READA$:A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48:IFA>16THENA=A-7
4255 IFB>16THENB=B-7
4260 IFA$="YY"THENRETURN
4265 POKE735+I,A*16+B:GOTO4250
```

GAMES SPECIAL



```
9 DIMGX%(6),GY%(6),OG%(6),SC$(20,32):HSC%=0:H$="NOBODY"
10 ENVELOPE1,1,1,1,-1,5,5,25,127,-4,0,-2,127,60:ENVELOPE2,1,10,20,-30,10,5,1
5,127,-2,0,-1,127,100:MODE 7:PROCINSTR:MODE 2:VDU 23;8202;0;0;0;:SC1%=0:L%=1:SC
%=0:MAN%=0:SHEET%=1
11 LIFE%=3:NG%=1:DGX%=0:DGY%=0:PROCMAZE:PROCSETUP
12 PROCMEN
13 COLOUR2:PRINTTAB(0,0);"SHEET ";SHEET%:COLOUR7:PRINTTAB(0,1);"SCORE ";SC%;
14 *FX 11 8
15 *FX 12 1
16 FORV%=0TONG%:FORN%=1TO12-SHEET%:PROCMAN:IFMAN%=1PROCSPURT
17 NEXT:PROCGHOST:NEXT:IFLIFE%=0GOTO82
18 GOTO16
19 DEFPROCSETUP
20 FLA%=0:GH%=254:DX%=0:DY%=0:FOR V%=0 TO NG%:GX%(V%)=12-V%:GY%(V%)=12:OG%(V
%)=247:NEXT:GX%(NG%+1)=12:GY%(NG%+1)=12
21 VDU 23,254,60,126,15,7,7,15,126,60,23,253,60,126,240,224,224,240,126,60,2
3,252,0,66,195,195,231,255,126,60,23,251,60,126,255,231,195,195,66,0,23,245,56,
124,254,146,218,254,254,146
22 X%=2:Y%=3
23 ENDPROC
24 DEFPROCMAN:IFLIFE%=0ENDPROC
25 SC$(X%,Y%)=" ":A$=INKEY$(0)
26 *FX 15 0
27 IFA$="N"DX%=-1:GH%=254
28 IFA$="M"DX%=1:GH%=253
29 IFA$="A"DY%=-1:GH%=252
30 IFA$="Z"DY%=1:GH%=251
31 IFDX%+X%<0THEN39
32 TT%=ASC(SC$((X%+DX%),(Y%+DY%)))
33 IFTT%=246THEN45
34 IFTT%=245THENPROCEND:ENDPROC
35 IFTT%=247SOUND1,1,ASC(A$),1
36 IFTT%=ASC("*")MAN%=1:SOUND3,2,10,100:VDU19,4,7,0,0,0:FORDEL%=1TO100:NEXT:
VDU19,4,COLOR%,0,0,0:IFSHEET%DIV5=SHEET%/5FLA%=1:TIME=0:VDU19,4,4,0,0,0
37 IFFLA%=1ANDTIME>500FLA%=0:VDU19,4,0,0,0,0
38 IFTT%=247ORTT%=ASC("*")ND%=ND%-1:IFND%=0THENPROCSHEET:ENDPROC
39 IFDX%<>0ORDY%<>0PRINTTAB(X%,Y%);" "
40 X%=X%+DX%:Y%=Y%+DY%
41 IFY%<2Y%=29
42 IFY%>29Y%=2
43 IFX%<0X%=19
44 IFX%>19X%=0
45 DX%=0:DY%=0:COLOUR3
46 PRINTTAB(X%,Y%);CHR$(GH%):S%=-(10*(TT%=247))-(100*(TT%=ASC("*"))):SC%=SC%
+S%:SC1%=SC1%+S%:COLOURRND(7):PRINTTAB(6,1);SC%;
47 ENDPROC
48 DEFPROCGHOST
49 IFLIFE%=0ENDPROC
50 SOUND2,1,10,1
51 IFV%>NG%ENDPROC
52 SC$(GX%(V%),GY%(V%))=CHR$(OG%(V%)):PROCMOVE:COLOUR1:IFOG%(V%)=246COLOUR4
53 PRINTTAB(GX%(V%),GY%(V%));CHR$(OG%(V%)):IFGX%(V%)+DGX%=X%ANDGY%(V%)+DGY%=
Y%THENPROCEND:ENDPROC
54 GX%(V%)=GX%(V%)+DGX%:GY%(V%)=GY%(V%)+DGY%:OG%(V%)=ASC(SC$(GX%(V%),GY%(V%)
)):COLOURV%+9:PRINTTAB(GX%(V%),GY%(V%));CHR$(245):SC$(GX%(V%),GY%(V%))=CHR$(245
):ENDPROC
55 DEFPROCMAZE
56 VDU23,247,0,0,0,24,24,0,0,0,23,246,255,255,255,255,255,255,255,255:COLOUR
2:FORYY%=2TO29:FORXX%=0TO19:SC$(XX%,YY%)=CHR$(247):NEXT:PRINTTAB(0,YY%);STRING$
(20,CHR$(247)):NEXT:COLOR%=4:IFSHEET%DIV5=SHEET%/5COLOR%=0
57 VDU19,4,COLOR%,0,0,0:COLOUR4:RESTORE:FORZ=1TO66:READX%,Y%:GOSUB63:Y%=31-Y
%:GOSUB63:NEXT
58 DATA0,2,1,2,2,2,3,2,4,2,5,2,6,2,7,2,8,2,0,3,0,4,0,5,0,6,0,7,0,8,0,9,0,10,
0,11,0,12,0,13,0,14,2,4,3,4,4,4,6,4,8,3,8,4,8,5,2,5,3,5,4,5,6,5,1,14,2,14,2,7,3
,7,4,7,2,9,2,10,2,11,2,12,6,7,7,7,8,7,9,7,9,8,9,9,4,8,4,9,4,10,4,12,4,13,4,14
59 DATA4,15,5,10,7,9,7,15,9,13,7,11,6,12,8,14,8,15,9,14,9,15,7,14,8,11
60 ND%=291:COLOUR14:FORAB=1TO4:READX,Y:PRINTTAB(X,Y);"*":TAB(0,0):SC$(X,Y)="
*":NEXT
61 DATA1,4,18,4,1,27,18,27
62 ENDPROC
63 GOSUB64:X%=19-X%
64 PRINTTAB(X%,Y%)CHR$(246);:SC$(X%,Y%)=CHR$(246):RETURN
65 DEFPROCX:DGX%=(X%<GX%(V%))-(X%>GX%(V%)):ENDPROC
66 DEFPROCY:DGY%=(Y%<GY%(V%))-(Y%>GY%(V%)):ENDPROC
67 DEFPROCLOOK:TT%=ASC(SC$(GX%(V%)+DGX%,GY%(V%)+DGY%)):ENDPROC
68 DEFPROCMOVE:DGX%=0:DGY%=0
69 PROCX:PROCLOOK:IFTT%=245DGX%=0
70 PROCY:PROCLOOK:IFTT%=245DGY%=0
71 ENDPROC
72 DEFPROCEND:SOUND 0,-15,4,10:PROCCOL:CLS:IF SC1%>10000 LIFE%=LIFE%+1:SC1%=
SC1%-10000
73 V%=0:LIFE%=LIFE%-1:IFLIFE%=0ENDPROC
74 SHEET%=SHEET%+1:PROCMAZE:PROCSETUP:PROCMEN:PROCMAN:COLOUR2:PRINTTAB(0,0);
"SHEET ";SHEET%:COLOUR7:PRINTTAB(0,1);"SCORE ";SC%;:ENDPROC
75 DEFPROCSHEET:IFSC1%>10000LIFE%=LIFE%+1:SC1%=SC1%-10000
76 V%=0:CLS:SHEET%=SHEET%+1:SC%=SC%+(1000*(SHEET%-1)):SC1%=SC1%+(1000*(SHEET
%-1)):COLOUR8:PRINTTAB(7,10);"BONUS":COLOUR15:PRINTTAB(6,12);SHEET%-1;" X 1000"
:FORA=1TO10000:NEXT
77 PROCMAZE:PROCSETUP:PROCMEN:PROCMAN:COLOUR2:PRINTTAB(0,0);"SHEET ":SHEET%:
COLOUR7:PRINTTAB(0,1);"SCORE ";SC%;:ENDPROC
78 DEFPROCMEN:IFLIFE%=1ENDPROC
79 COLOUR3:FORA%=2TOLIFE%:PRINTTAB(A%,30);CHR$(254);TAB(0,0);:NEXT:ENDPROC
80 DEFPROCCOL:FORC=0TO15:FORN=1TO100:NEXT:VDU 19,4,C,0,0,0:NEXT:VDU 19,4,4,0
```

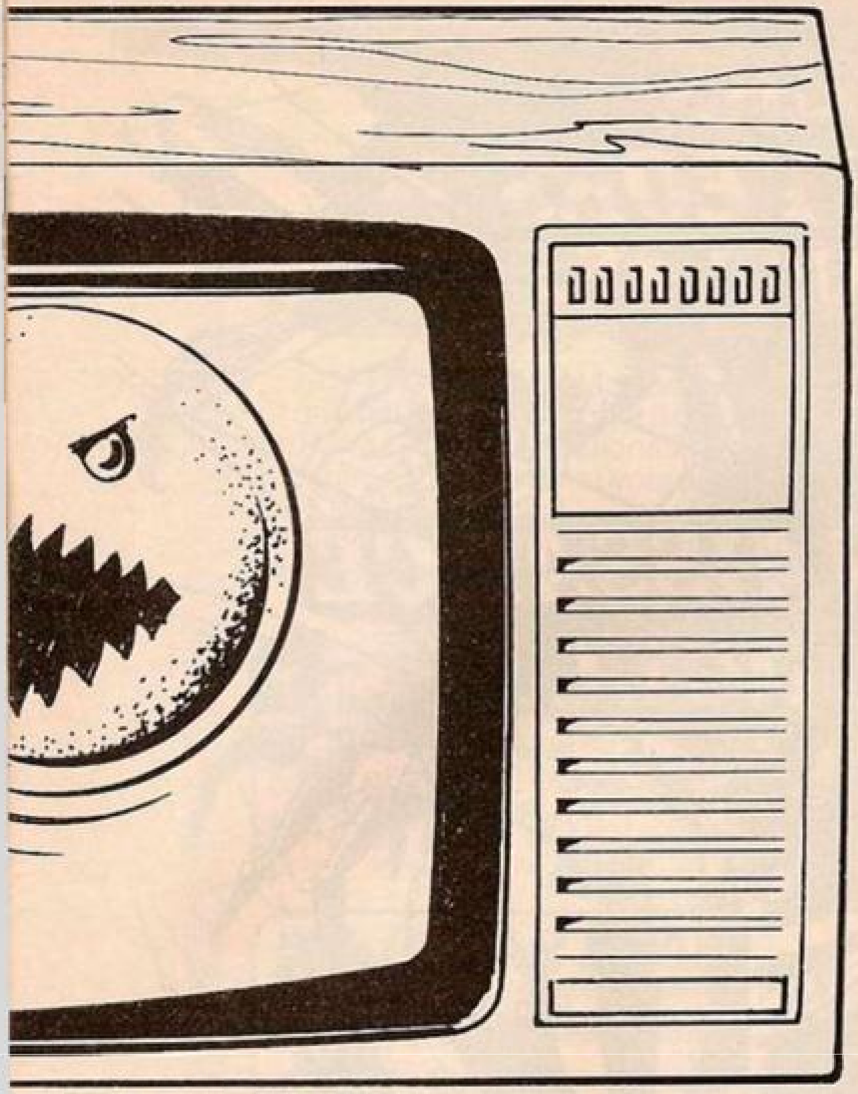
THE GAME in this article is a very enjoyable, and addictive, game for the 32K BBC Model B. It is slightly different from the arcade implementation in that there are only two ghosts who can go through walls and the function of the power pills is to stop the ghosts chasing the Muncher for a few seconds, giving him a chance to eat more dots and so get to the higher sheets. The player gets bonuses by totally clearing a sheet.

Every fifth maze is an invisible one, but the player must remember the pathways, in order to follow them. When playing such a sheet, the maze is made visible for about 10 seconds, when a power pill, or thunderbuster, is eaten. The following keys are used to move: A to go up, Z to go down, N to go left and M to go right. 10 points are given for the dots that it eats all the time and 100 points are given for*, which are thunderbusters.

A bonus of the value 1,000 multiplied by the number of sheets is given every time a sheet is totally eaten, thus 1,000 points are awarded for clearing the first maze and 13,000 points for clearing maze number 13.

An extra Muncher is given every time you score 10,000 points: you have three lives to begin with.

To begin with, you may think that the game is very easy, as the ghosts move very slowly, but they get faster every sheet, until they become half your speed on sheet 11, from then on their speed remains constant. Here are a



HERE COMES THE MAZE MUNCH

A deceptively easy game to start with, this BBC version of a well known arcade game written by David Griffin is definitely worth getting your teeth into.

few hints. It is a good idea to clear as much of the maze as you can without using the thunderbusters. On the lower sheets move straight to the middle of the maze, and clear that area first, as it is the most difficult.

When the ghosts are moving the fastest, clear the outer regions of the maze first, reserving the thunderbusters to help in clearing the centre. Try not to leave individual dots, but clear large areas of the maze at once. Don't hesitate or panic, it is quite easy to get out of most situations.

If you want to change the number of ghosts, change the value of NG% in line 11. I would advise against conversion to other computers because this program uses many special functions of the BBC. But in case anyone wants to try here is a list of some of the BBC peculiarities used in this implementation.

Envelope defines the envelope used in the Sound command — this can be ignored. Mode changes the display mode, Mode 7 is a teletext display 40×25, Mode 2 is a high-resolution display, with characters on a 20×32 grid.

VDU 23 defines characters on an eight-by-eight grid. The first parameter is the character number, the following eight define the shape row by row, with the decimal equivalent of the binary number representing the character row. The VDU in line 10 stops the cursor flashing.

Proc calls a procedure defined by DefProc; this should be replaced by a Gosub command on other computers.

Colour sets the current text colour. Print Tab (X,Y) positions the cursor at position X,Y on the screen. All the *FX commands can be ignored.

VDU 19 Xl, C2, 0, 0, 0 sets colour Cl to colour C2; this is used in making the maze invisible.

RND gives a random integer between 1 and the number inside the brackets. Sound A, B, C, D plays a note on channel A, of volume B, of pitch C, for duration D. Div signifies integer division.

The command Get$ waits for a key to be pressed and puts the string value of that key in the suitable variable.

Inkey$(n) waits for n cycles of the clock or until a key has been pressed, and puts the string value of that key in the suitable variable. The program puts the whole screen into array SC$ and can use this array to see if the man is trying to go into a wall, or has eaten something.

The highest score so far attained is 10,154,250 — achieved after playing continuously for several hours, and reaching sheet 999. ■

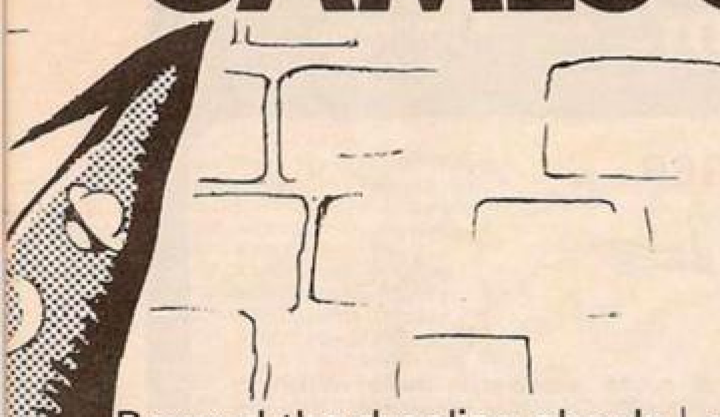
```
,0,0:ENDPROC
   81 DEFPROCSPURT:FORSP%=1TO(RND(100)+20):PROCMAN:NEXT:MAN%=0:ENDPROC
   82 MODE7
   83 *FX 15 0
   84 *FX 11 0
   85 PRINTTAB(10,5);CHR$(141);CHR$(136);"YOU'RE DEAD!!";TAB(10,6);CHR$(141);CH
R$(136);"YOU'RE DEAD!!"
   86 PRINTTAB(8,10);"YOU SCORED ";SC%
   87 IFSC%>HSC%PRINTTAB(8,12);"THE HIGHEST SO FAR"ELSEPRINTTAB(4,12);"THE BEST
 WAS ";HSC%;" BY ";H$
   88 IFSC%>HSC%INPUT'''"   YOUR NAME "H$:HSC%=SC%
   89 PRINTTAB(5,22);CHR$(129);CHR$(141);"ANOTHER GAME ?";TAB(5,23);CHR$(129);C
HR$(141);"ANOTHER GAME ?"
   90 REPEATA$=GET$:UNTILA$="Y"ORA$="N"
   91 IFA$="Y"THEN10
   92 END
   93 DEFPROCINSTR
   94 PRINTTAB(2,0);"MUNCHER(C) David Griffin 26:6:82"
   95 PRINT'"   In this game you must move a man      around a maze, eating dots
 as you do so.He is being pursued by two evil ghosts  who can only be stopped b
y eating a     flashing thunderbuster, and even then   for a short while only!"
   96 PRINT"   After clearing the maze of dots and  thunderbusters, a new one i
s given.    Every fifth maze is invisible, just to  add extra interest and dif
ficulty."
   97 PRINT"   An extra man is given every 10,000   points.",''"   To move use
the following keys :-",'"           'A' to go UP",'"              'Z'(to go DOWN",'"
       'N' to go LEFT",'"           'M' to go RIGHT"
   98 PRINT'';"     PRESS ANY KEY TO PLAY...              ":REPEATA$=GET$:UNTILA$<>
   99 ENDPROC
```

```
  2A=0
  6dD=90;K=0;V=0;M=0;@=3;I=0;L=0;S=1;W=0;C=0;B=0
 15J=£9500;H=£8400;!£23=£9100;P=£2800
 20DIMCC(11),BB(105),DD(15)
 25 P.$12
 30?18=£82;G.e
 70hF.F=0TO760;J?(F)=0;N.;CC11=0
 75F.F=1TO10;CC(F)=0
 80D=(F*4+(R.%3))*10;J?(D+8)=F
 90C=(F*7+(R.%3))*10;J?(C+9)=F
 95E=C;N.F;G.p
100oP.''"OPTIONS-"';IFV>0P."bRIBE,"
101IFI=1ORW=1ORX?8=3ORX?8=1P."tAKE,"
102IFW=1P."cAST SPELL,"
104P.$BB101;Y=(10-X?9)*20
105jF=0;DOLI.DD0;WAIT;F=F+1;U.?£80<>32ORF=Y
106Q=?£80;IFF=Y IFX?9<11 IFX?9>0 IFX?9*40>D G.a
107IFF=Y G.j
110P.';IFQ=65P."YOU ATTACK";G.a
120IFQ=66IFV>0P."BRIBE ";G.b
125IFQ=67P."SPELL";G.w
130IFQ=76P.$12"LOOK";R=0;G.f
140IFQ=84IFW=1ORI=1ORX?8=3 ORX?8=1P.$12"TAKE";G.t
150IFQ=78P."NORTH";N=2;G.c
160IFQ=83P."SOUTH";N=3;G.c
170IFQ=87P."WEST";N=5;G.c
180IFQ=69P."EAST";N=4;G.c
190IFQ=85P."UP";N=6;G.c
210IFQ=68P."DOWN";N=7;G.c
220IFQ=77P.$BB102;G.j
230lP.'"OUCH!!"'$BB105;D=D-10;G.o
240cIFX?N=1 G.l
245IFK=1ORB=1G.m
250IFX?N>9IFK=0P.'"YOU CAN'T IT'S LOCKED";G.o
260mIFN=6IFD<100P.'"YOU CAN'T YOU ARE TOO WEAK";G.o
270IFN=2L=L-50;G.p
280IFN=3L=L+50;G.p
290IFN=4L=L+10;G.p
300IFN=5L=L-10;G.p
310IFN=6L=L-250;G.p
320IFN=7L=L+250;G.p
500wIFW=1B=1;P.'"SPELLED";IFD<200D=200
510IFX?9<10IFX?9>0G.s
520G.o
1000pF.F=1TO99;WAIT;N.;@=3;?£E1=0;CLEAR0;P.$30
1004iX=J+L
1005P=L-250;;IFD<200D=D+10
1006IFL<250X?6=1;P=L
1007IFL>490X?7=1;P=L-500
1010IFP<50X?2=1
1030IFP>190X?3=1
1040IFP%50=40X?4=1
1050IFP%50=0X?5=1
1080Z=1000;?X=L/10;F=1
1085kN=X?F;IFF>7G.q
1090IFN=0N=S;S=S+1;IFS>12S=1
1100IFF>5IFN>7N=1
1110qX?F=N;Z=Z+200
1120IFN<>0G.(Z)
1125rF=F+1;IFF<10G.k
1130IFX?9=10IFW=0G.s
1135IFCC11=11IFD>80D=D-50;IFL=0G.7400
1140B=0;G.o
1200IFL=0P.'$BB95,$BB(N+2)" IF "$BB80'$BB54;G.r
1210P.'$BB2,$BB(N+2)';G.r
1400IF(L-50)>0IFX?-47=0X?-47=N
1405P.'$BB15,$BB(15+N);G.r
1600IF(L+50)<750IFX?52=0X?52=N
1605P.'$BB28,$BB(N+15);G.r
1800IF(L+10)<750IFX?15=0X?15=N
1805P.'$BB29,$BB(15+N);G.r
2000IF(L-10)>0IFX?-6=0X?-6=N
2005P.'$BB30,$BB(15+N);G.r
2200IF(L-250)>0IFX?-243=0X?-243=N
2205IFN>6N=1
2210IFN>1P.'$BB(29+N)
2220G.r
2400IF(L+250)<750IFX?256=0X?256=N
2405IFN=7G.x
2410IFN>1P.'$BB(34+N)
2420G.r
2470xIFL>490ORI=1ORW=1G.r
2475LI.DD1
2480P.'$BB41;L=L+250;D=D-50;J?(L+6)=1;J?(L+7)=1;S=1;G.i
2600IFI=1ORW=1ORX?8=3ORX?8=1ORX?8=1G.u
2601G.r
2605uR=(A.R.%7+1)*10;P.'$BB42
2610IFX?8=1G.v
2620IFX?8=6P.R
2630P.$BB(43+N);G.r
2690vP.$BB43;S=1;IFW=1G.r
2695P.'$BB44;L=((A.R.%70)+5)*10;LI.DD5;G.p
2800P.'$BB55
2802IFN>10P."DEAD ";P.$BB(N-45);G.o
2805P.$BB(55+N);IFN*20>D;IFN<>10 G.a
2810IFW=0IFN=10G.s
2820G.r
3610sR=(L+(R.%5*10));IFJ?(R+9)<>0ORR>740ORR<0G.s
3612LI.DD5
3615P.'"THE "$BB(55+X?9),$BB66
3620IFV=0IFJ?(R+8)=0J?(R+8)=5
3622IFJ?(R+8)=0J?(R+8)=6
3625IFX?9=10;E=R;J?(R+8)=6
3630J?(R+9)=X?9;X?9=0;G.o
4000aIFN=0 P." WHAT";G.o
4001G=((A.R.%10+1)-(D/50)+N+(M/3))*10;IFG>100G=100
```

(listing continued on page 65)



GAMES SPECIAL



ATOM QUEST

Beyond the drooling ghouls you'll find economy and complexity in Colin Comber's Atom labyrinth as you seek the chalice.

QUEST IS AN Adventure/Labyrinth game. The object of the game is to become strong enough to find and overcome an evil sorcerer, recover the magic chalice and return to the starting position. There are items scattered through the cells which may help in the Quest. Moves are made by typing the initial letter of the selected option. With luck the number of options will increase.

A magic wand is visible, but a lamp must be found before the other items can be seen. The keyboard scan is associated with a countdown which permits you to move, providing your reaction is faster than the reaction of the monster in that cell.

Using an article in *Your Computer* by Derek Haslam — Software File October 1981 — on storing strings in a string array enabled me to fit the game into the Atom's memory.

Strings can be stored in the upper text space using line numbers. To access the upper text space type

?18 = #82

The string start locations are read into array BB, which is also stored in the upper text space. !21 = #9100 — line 15 — moves all arrays from Top where arrays are normally stored to where you decide to store them. In this case it is #9100, a safe distance above the last string. Routine 950-995 reads the first character of string $?H into array BB. To identify the strings take the line number, divide by 10 and take way 100. Here are two examples:

$BB1 = line 1010

and

$BB105 = line 2050

The data for the cells in the Labyrinth is arranged in a 75 by 10 matrix. A conventional word array would consume too much memory, but it is possible to store the data in a byte vector since all the values are smaller than 255 and can be stored in single bytes. This matrix is represented using a one-dimensional array, and the position of an array variable is then calculated by J?n.

The Labyrinth array J?0 to J?749 is also stored in the upper text space J = #9500 — line 15.

A move north, east, west, south, up or down modifies variable L ,J?L = X, and the nine features of a cell are stored thus:

X?0 = Cell number = L/10	
X?1 = Cell description	$BB 3-14
X?2 = North exit	$BB16-26
X?3 = South exit	$BB16-26
X?4 = East exit	$BB16-26
X?5 = West exit	$BB16-26
X?6 = Up exit	$BB31-35
X?7 = Down exit	$BB36-41
X?8 = Object in cell	$BB43-54
X?9 = Character in cell	$BB56-65

Initially all the cell features are zeroed — line 70. As a cell is explored, routine 1005-1050 checks for external walls and inserts stone walls to prevent the Adventurer falling out of the Labyrinth and being struck down by a Space Invader.

The internal walls, exits and stairs are generated by the routine 1085-1110, which takes a number from the sequence 1-12. This means cell features are determined by the Adventurer's exploration so, although the Labyrinth remains stable and retraceable, each Quest can be unique.

The variables.

- A Adventurer count
- B Spell flag
- C Character seed
- D Defence factor
- E Sorcerer's location
- F For-Next counter
- G Pseudo On-Goto variable
- H String counter H = #8400
- I Lamp flag
- J Start of byte vector J = #9500
- K Key flag
- L Location variable
- M Monster counter
- N Dummy variable in p routine
- O Object seed
- P Dummy variable in p routine
- Q ?#80
- R Random number
- S Seed for pseudo-randomise in p routine
- T Take counter in t routine
- U
- V Gold pieces
- W Wand flag
- X X = J?L
- Y Keyboard scan counter
- Z 1000 + in p pseudo On-Goto

Outline of the program.

2-95	Set variables zero array s J-J?749 and CC Seed objects Character seed
100 o	Options keyboard scan
105 j	If character present, countdown, Goto a — attack routines
1000 p	Describe cell Describe object
2820	Describe character
3600 s	Character magically disappears
4000 a	Attack routine
5000 t	Take object
5200 f	List objects, display strength
5300	Drop-object option
6000	Sorcerer defeated: find chalice
7000 b	Bribe option
7060	Bribe for sorcerer's location
7400	Chalice safe: quest successful
?18 = #82	
890	Keyboard scan, assembler source code
910	Sound effects, assembler source code
940	If strings have been read once Goto 1.text p
950	Read string starts into array BB
1000	Goto 1.text p
1010	First string
2050	Last string

The memory map is as follows:

#2800	Keyboard scan Sound effects
#2900	Main program
#3C00	Main program
#8200	Assembler source program assembled to #2800 String-reading routine String data
#8E00	String data
#9100	Arrays BB,CC,DD
#9500	Byte array J?0
#97EE	to J?749

To test the program without continually getting killed off, Run the program. When the first cell has been described, press Escape, and then type

K = 1;W = 1;D = 1000;G.p;RETURN.ESCAPE,G.p

which is quite a useful way of cheating. Until the program has been cleared of typing errors, Save the program as two separate files with different names.

When the program is running it can be saved as one complete file. It is possible to load this 8K program in one go using the *FLoad command.

*SAVE"QUEST"2900 3D00

When it has completed, rewind and *Cat until 3B00 is displayed; allow this entire memory block to pass the recording head of your cassette recorder, listening for the brief carrier tone between memory blocks and stop the recorder before the header of 3C00 is displayed. Now Break, Old and *Save"Quest" 8200 8E00 and record, erasing the dummy memory block and replacing it with the upper text data. This fools the Atom into loading similarly named files to separate loading addresses.

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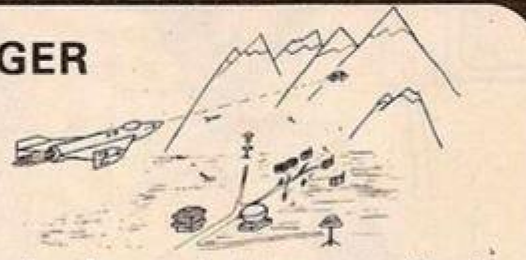
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(listing continued from page 62)

```
4002F.F=1TO50;WAIT;N.;IFG<10G=10
4004IFN>100P.'"CORPSE MUTILATOR";G.o
4005P.'"THE ",$BB(N+55)" "$BB67
4006P.'$BB68
4007P.'"THE ",$BB(N+55)" ";G.(G+4000)
4010P.$BB69;D=D+20;M=M+1
4011IFN=10 G.6000
4012yR=(A.R.%70+2)*10;IFJ?(R+9)<>0G.y
4013J?(R+9)=X?9
4015X?9=(X?9)+100;N=X?9;G.o
4020R=(A.R.%9+1)*10;P.$BB70,R,$BB49" AND ";CC6=6;V=V+R;G.s
4030IFV>0P.$BB71;D=D+50;V=0;CC6=0;CC5=0;G.s
4040P.$BB72;D=D+30;G.a
4050P.$BB73;D=D+20;G.a
4060P.$BB74;D=D-10;G.a
4070P.$BB75;D=D-20;G.a
4080P.$BB76;D=D-10;G.o
4090P.$BB77;D=D/2;G.o
4100IFD>10IFW=1IFN<>10G.4090
4105F.F=1TO99;WAIT;N.
4110P.$12"THE "$BB(N+55)" "$BB78'';LI.DD5;G.7500
5000tT=X?8;IFT<2 P.'$BB79;G.o
5010@=2;CC(T)=T;X?8=0;G.(T*10+5000)
5020K=1;G.f
5030I=1;G.f
5040D=D-200;G.f
5050V=V+999;D=D-300;CC6=6;G.f
5060V=V+R;R=(A.R.%75+1)*10;J?(R+8)=6;G.f
5070G.f
5080D=D+200;G.f
5090D=D+300;G.f
5100W=1;G.f
5110IFCC10=10 CC10=0;W=0;B=1;LI.DD5;P.'"THE MAGIC WAND "$BB66
5200fP.'$BB80;R=V;T=0
5210F.F=2TO11
5220IFF=6IFF=CC(F)P.R" "
5230IFF=CC(F)P.$BB(43+F)",";T=1
5235N.;IFT=0P." "$BB81
5240G=D/100;IFG>6G=6
5250IFG<1G=1
5255IFCC7=7P.'$BB96,J?L
5260P.'"YOU ARE "$BB(82+G);IFT=0G.i
5300P.'$BB99"ANYTHING"'$BB100'
5310 DO LI.DD0;U.?£80<>32
5315 IF?£80<>89 G.i
5320F.F=2TO11;IFCC(F)<>F G.n
5330P.$BB99$BB(CC(F)+43)'$BB100'
5340 DO LI.DD0;U.?£80<>32
5345 IF?£80<>89 G,n
5350IFX?8=0G.5390
5360R=(A.R.%72+2)*10;IFJ?(R+8)<>0G.5360
5370J?(R+8)=X?8
5380P.'"THE "$BB(43+J?(R+8))$BB66
5390X?8=CC(F);CC(F)=0
5400IFF=2K=0
5410IFF=3I=0
5420IFF=4D=D+200
5430IFF=5V=0;CC6=0;D=D+200
5440IFF=6V=0;CC5=0;D=D+200
5450IFF=8D=D-200
5460IFF=9D=D-300
5470IFF=10W=0
5480nN.;G.i
6000X?9=0;X?8=11;P.'$BB42'$BB54'$BB82;G.o
7000bIFX?9=0P.'"BRIBE WHO?";G.o
7005IFX?9>11 P."DEAD "$BB(X?9-45)"?";G.o
7010P.'$BB80 V,$BB49
7020 P.'"FOR",X?9*10" "$BB49" THE "$BB(X?9+55)'$BB89''
7040P.'"AGREED?"$BB100
7041DOLI.DD0;Q=?£80;U.Q<>32
7042IFQ<>89ORV<(X?9*10)G.a
7045P.'$BB90;V=V-(X?9*10)
7050IFX?9>4ORCC7<>7G.7090
7060P.'"FOR",(X?9*10)" "$BB49" THE "$BB(X?9+55)
7070P.'$BB103" THE "$BB65
7080P.'"AGREED?"$BB100
7081DOLI.DD0;Q=?£80;U.Q<>32
7082IFQ<>89ORV<(X?9*10)G.a
7085V=V-(X?9*10);P.'"THE "$BB65$BB104,E/10
7090M=M+1
7100P.'"THE "$BB(X?9+55)'$BB66;X?9=0;G.o
7400 LI.DD1;LI.DD1;P.$12
7402P.$BB54" IS SAFE"
7405IFV>0P.'"AND YOU FOUND"V,$BB49
7410P.'$BB97';IFV>0P.$BB98
7415G.7515
7500P.'$BB91
7510A=A+1
7515P.'$BB92,M'$BB93,A'$BB94';LI.£FFE3;G.d
7520 END
?18=£82
890eP.$21;F.F=1TO2
895 F.F=1TO2
900[:DD0 JSR £FE71;TYA;ADC @32;STA £90;RTS
910:DD1 LDA @1;STA £81
920:DD2 LDY @10;:DD3 LDA £B002;EOR @4;STA £B002;LDX £81
930:DD4 INX;BNE DD4;DEY;BNE DD3;INC £81;BNE DD2;RTS
931:DD5 LDA @191;STA £82
932:DD6 LDY @64
933:DD7 LDX £82
934 LDA  £B002;EOR @4;STA  £B002
935:DD8  DEX;BNE DD8
936 DEY;BNE DD7;LDY £82
937:DD9 NOP;DEY;BNE DD9
938 LDA £82;SEC;SBC @£3;BCC DD10;STA £82;JMP DD6
939:DD10 RTS
940];N.;P.$6;IF?BB1=89 G.g
950 DOH=H+1;U.?H=13ANDH?3=100
960 F.F=1TO105
970DOH=H+1;U.H?-4=13
980BB(F)=H
990IFF=1LI.DD5;P.$BB1
995N.
1000g?18=£29;G.h
1010dYOU ARE BEING TRANSPORTED TO A  MYSTERIOUS PLACE
1020 YOU ARE IN A
1030 COLD CELLAR
1040 DARK PANELLED ROOM
1050 MISTY CAVE
1060 DARK ECHOING SPACE
1070 SMALL CHAMBER
1080 CRAMPED ANTEROOM
1090 DARK VAULT
1100 LOW CHAMBER
1110 HIGH VAULTED HALL
1120 DUSTY ROOM
1130 COLD DAMP ROOM
1140 COLD MISTY CHAMBER
1150 NORTHWARDS IS A
1160 STONE WALL
1170 DARK CURTAIN
1180 NARROW DOORWAY
1190 DARK ENTRANCE
1200 DARK ARCHWAY
1210 DARK DOORWAY
1220 DOOR
1230 LOW ARCH
1240 GLOOMY PORTAL
1250 THICK DOOR
1260 WOODEN DOOR
1270 RUSTY IRON GATE
1280 SOUTHWARDS IS A
1290 TO THE EAST IS A
1300 WESTWARDS IS A
1310 A STAIRCASE LEADS UPWARDS
1320 A LADDER LEADS UPWARDS
1330 A ROPE IS HANGING FROM ABOVE
1340 STEPS LEAD UP
1350 SPIRAL STAIRS WIND UPWARDS
1360 A STAIRCASE LEADS DOWN
1370 A LADDER LEADS DOWN
1380 A ROPE HANGS DOWNWARDS
1390 STEPS LEAD DOWN
1400 SPIRAL STAIRS WIND DOWN
1410 OOF!!YOU HAVE FALLEN DOWN A HOLE
1420 ON THE FLOOR YOU CAN SEE
1430 YOU'VE TRODDEN IN THE MAGIC TURD
1440 WHICH TRANSPORTED YOU
1450 A BUNCH OF KEYS
1460 AN OLD BRASS LAMP
1470 A SMALL SCARLET FISH
1480 A HEAVY CASKET
1490 GOLD PIECES
1500 A SCRAP OF PAPER
1510 A MAGIC SHIELD
1520 A MAGIC SWORD
1530 A THIN IRON ROD
1540 THE*magic*chalice*
1550 BEHIND YOU IS A
1560 GOBLIN
1570 MALIGNANT DWARF
1580 WRAITH
1590 TROLL
1600 THRAGG
1610 DROOLING GHOUL
1620 KOBOLD
1630 GERYON
1640 PIT FIEND
1650 SORCERER WITH THE chalice YOU SEEK
1660  MAGICALLY DISAPPEARS
1670 SMITES YOU MIGHTILY
1680 YOU STRIKE BACK BRAVELY
1690 EXPIRES mESSILY
1700 SCREAMS,THROWS
9902 SNATCHES YOUR GOLD AND
1720 SMITES YOU LIGHTLY
1730 IS STUNNED
1740 INJURES YOU
1750 STUNS YOU , YOU FALL BACK
1760 INJURES YOU SEVERELY
1770 SMITES YOU MIGHTILY
1780 KILLS YOU
1790 PICK UP WHAT?
1800 YOU ARE CARRYING
1810 NOTHING
1820 TAKE THE chalice AND FLEE
1830 WEAK
1840 NOT VERY STRONG
1850 STRONG
1860 QUITE STRONG
1870 VERY STRONG
1880 ALMOST INVINCIBLE
1890 WILL LEAVE YOU IN PEACE
1900 THAT WILL DO NICELY
1910 YOU DIDN'T MAKE IT-TOUGH
1920 HUMANS
1930 MONSTERS AND THINGS
1940 IF YOU'D LIKE TO TRY AGAIN PRESSRETURN
1950 YOU CAN ONLY RETURN TO THE REAL WORLD THROUGH THIS
1960 THE MAP SHOWS YOU'RE IN ROOM
1970 WHAT A BRAVE ADVENTURER
1980 YOU WON YOU CAN KEEP THE GOLD
1990 DO YOU WANT TO DROP
2000 (yES/nO)
2010 lOOK,aTTACK OR mOVE ?
2020 DIRECTION-nORTH,sOUTH,wEST,eAST,uP OR dOWN ?
2030 WILL TELL YOU WHERE TO FIND THE
2040  IS IN ROOM
2050 NO EXIT IN THAT DIRECTION DUMMY!
```

ZX KEY

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NOTE

The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute job and requires no electronic skills or any soldering.

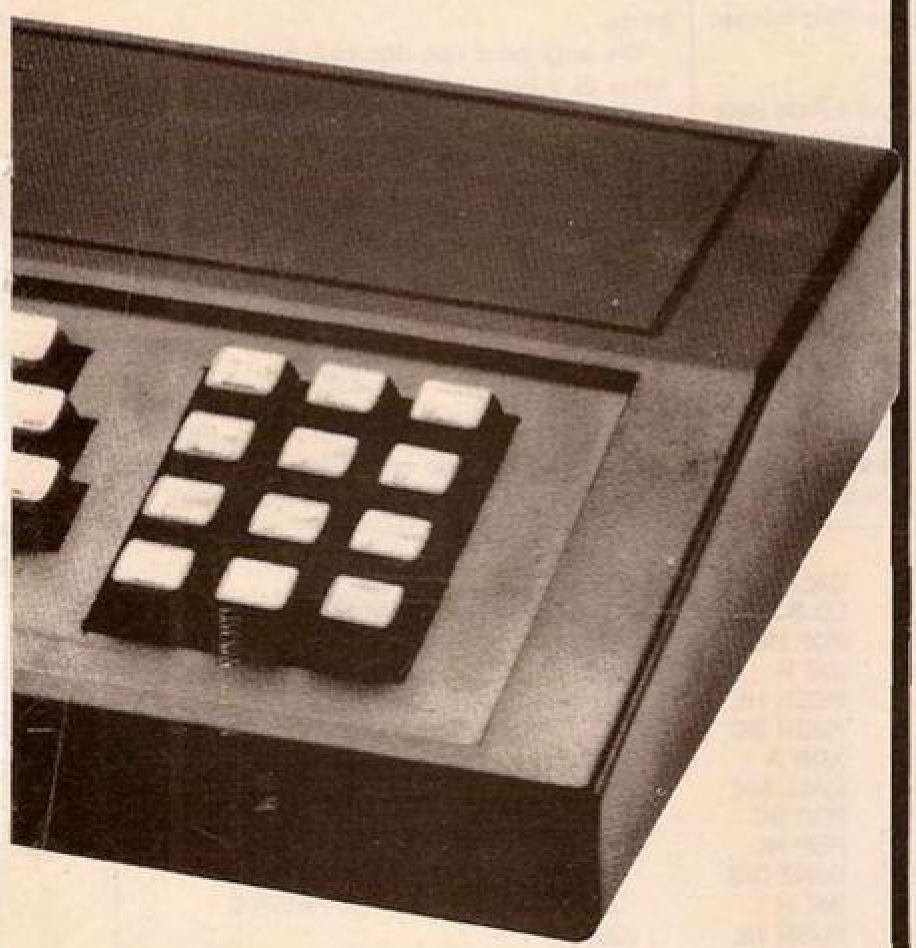
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Access BARCLAYCARD VISA

PROGRAM 1 WILL enable two people to play chess on an unexpanded ZX-81. The program, which uses Slow mode and Sinclair ROM routines, is not suitable for the ZX-80 or a new ROM Z-80.

This part deals with the general details of the production of the board. The program, which was part of a technical exercise to see how much could be squeezed into the Sinclair pint-pot, ended up with a playing 1K game of chess.

CHESS II

Follow the instructions carefully; with a machine-code program an error will cause the system to crash and you may need to switch the machine off and on to regain control, before reloading the program from tape. Always Save prior to running any new version of a machine-code program for the first time.

Figure 1 shows the playing board. It gives a nice, easily-read display. The first problem is to produce a Rem line containing 574 spaces. It is best to make one Rem statement and edit the line number to give Rems 1 to 5. You will have to type clear before you edit the lines.

Do not forget to use Fast mode. Next type in Rem 6, see figure 3. If this has been done correctly then Peek 17087 will give 32 and Peek 17088 will give 118. Now type in lines 9 to 15. Next type list 1 Newline and now:

POKE 16510,0 prevents you from editing first line
POKE 16511,64
POKE 16512,2

Then Save 1. As the production of a Rem statement of the correct length appears to be a major problem, let me explain what happens in a bit more detail.

The way Sinclair presents each Rem line is as follows: two bytes contain the line number, two bytes contain the subsequent number of bytes in the line, one byte stores the code for the keyword Rem, 100 is the number of bytes in line, one byte contains the line end. This gives 2+2+1+100+1 and provides 100 bytes of free space, but any subsequent Rem statement to be combined will be able to use all the bytes for data, thus 2+2+1+100+1 = 106 bytes.

We only need one line end, one number of bytes in a line and one line number, thus in our case we have:

1st	Rem	Statement	100 bytes usable
2nd	,,	,,	106
3rd	,,	,,	106
4th	,,	,,	106
5th	,,	,,	106
6th	,,	,,	50
			574

Now if we want 574 bytes in a line, plus one Rem code and one end-of-line code — that adds up to a total of 576 — we change the

Figure 7.

```
16514  55  51  39  48  54  39  51  55   PIECE TABLES
       183 179 167 176 182 167 179 183
16530  PUSH BC     197                  PRINT A CHARACTER
       PUSH AF     245
       CALL NN     205 245   8
       POP AF      241
       RST 16      215
       POP BC      193
       INC A        60
       RET         201
16540  CALL DP2    205 140  65          BLACK AND WHITE SQUARES
       LD B N        6  90
       LD A (HL)   126
       CP N        254   0
       JP NZ DIS    32   2
       LD (HL) N    54 128
       INC HL       35
       INC HL       35
       DJNZ DIS     16 245
       RET         201
       PUSH AF     245
       PUSH HL     229
       POP BC      193
       CALL NN     205 245   8
       LD B N        6   8
       POP AF      241
       RST 16      215
       DJNZ DIS     16 253
       RET         201
16570  LD BC NN      1   0   2          GREY BACKCLOTH
       PUSH BC     197
       CALL NN     205 245   8
       LD A N       62   8
       LD B N        6  14
       RST 16      215
       DJNZ DIS     16 253
       POP BC      193
       INC B         4
       LD A N       62  15
       CP B        184
       JP NZ DIS    32 238
       LD BC NN      1   2   4          WHITE PIECES
       CALL NN     205 245   8
       LD DE NN     17 130  64
       LD BC NN      1   8   0
       CALL NN     205 107  11
       LD HL NN     33   2   5          WHITE PAWNS
       PUSH HL     229
       LD A N       62  53

       CALL NN     205 173  64
       LD B N        6   4              SPACES
       POP HL      225
       INC H        36
       PUSH HL     229
       PUSH BC     197
       XOR A       175
       CALL NN     205 173  64
       POP BC      193
       POP HL      225
       DJNZ DIS     16 245
       INC H        36                  BLACK PAWNS
       PUSH HL     229
       LD A N       62 181
       CALL NN     205 173  64
       POP HL      225
       INC H        36                  BLACK PIECES
       LD B H       68
       LD C L       77
       CALL NN     205 245   8
       LD DE NN     17 138  64
       LD BC NN      1   8   0
       CALL NN     205 107  11
16652  LD A N       62  38              LETTERS
       LD BC NN      1   9  14
       CALL NN     205 146  64
       INC C        13
       CP N        254  46
       JP NZ DIS    32 248
       LD A N       62  29              NUMBERS
       LD BC NN      1  12   4
       CALL NN     205 146  64
       INC B         4
       CP N        254  37
       JP NZ DIS    32 248
       CALL B/W    205 156  64
       RET         201
                                        DISPLAY POINTERS
16780  LD C N       14  34              DP2
       JR DIS       24  10
       LD C N       14  15              DP1
       JR DIS       24   6
       LD C N       14 180              DP4
       JR DIS       24   2
       LD C N       14 195              DP5
       LD B N        6   0
       LD HL (NN)   42  12  64
       ADD HL BC     9
       RET         201
```

N 1K MACHINE CODE

David Horne shows you how to cram a working chess program into just 1,000 bytes of memory — part 1 of a three-part series.

"number of bytes in line from here" figure to the two-byte equivalent of 576.

POKE 16512, INT (576/2)............2
POKE 16511, 576 - (256*INT(576/2))........64

Returning to the program, List should give a display of a portion of figure 3, depending on how much memory is attached to your machine.

If you have an expansion attached, now is the time to Reset RAMtop:

POKE 16389, 72

then print USR 1040. To produce the board, type Run 10 and enter in the data in figure 4 from address 16514 to 16681. If you make a mistake, make a note of the number in the top left-hand corner of the screen and the correct entry that should have been typed, and then continue inputting the data. On completion Save 2 then make your corrections by Poking address + 1, correcting the entry and then Save again.

Now edit line 10 to read

FOR A = 16780 TO 16800

and Run 10. Enter data in figure 5 from address 16780 to 16800, now Save 3. If you have got it right, delete lines 10 to 15 and Run. This should produce the display in figure 1. If not, you have made an error. Check any errors with the following pointer.

16514 Table of pieces on board
16530 display
16540 black and white squares

If they go across the screen it means you forgot to reset RAMtop.

16570 grey background
16591 white pieces
16606 white pawns
16615 spaces
16629 black pawns
16637 black pieces
16652 letters and numbers

The above will I hope give you some idea where a fault may be. If you have a printer, use LList for comparison.

Your screen should look like figure 6 if you list; the amount of information depends on memory size. Temporarily try 9 Stop and Delete lines 10 to 15, enabling you to see more. You can also try the program in figure 7 after deleting all lines except 9 and the Rem statement.

```
10 FOR A = 16514 TO 16570
13 PRINT AT 1, 0; A, PEEK A
14 STOP
15 CLS
16 NEXT A
```

Use Continue to step through the program until the error is found. The above seems a bit long-winded, but there are problems which sometimes arise when listing or deleting lines in a program which contains a very long Rem statement.

You can see what I mean if you get into Slow List and try to delete line 9. Your machine goes into an infinite loop. You will have to pull the plug and reload to get your machine operational again.

The following represents a brief technical outline covering the salient points of the machine-code routine so far. The disassembled listing and the accompanying notes cover the program up to the production of the board.

The machine code is entered at address 16570. The register bc is used by the Sinclair Routine — SR — at 245, 8 to set the Print At position. The a contains the colour, b the number of times it is to be printed, RST 16 is the SR for Print; this routine Prints 14 shaded characters across the screen.

Next the Print At register row is incremented, checked to see if we are at row 14, and if not, the next row is written, producing the backcloth. After row 14 we start the next routine.

Write the white pieces, here bc uses the SR at 245, 8 to set Print At position to row 2 column 4. The SR at 107, 11 is then used to print a String, the white pieces. A quick change of the Print At position, then subroutine at 16557 prints a series of a, b times, initially white pawns, four rows of spaces, then black pawns; HL holds the print position. Now return to the print-a-string routine and copy the black pieces.

At address 16652 we have a routine which annotates the board with horizontal letters and vertical numbers. Address 16678 calls the subroutine at 16540 to write the black squares. Here we find the start position of the board; then every even address to the end of the board is tested. If an address is empty, insert a black square, otherwise leave it alone. And there we have the board.

The routines at 16780 are used to point to the position of various board parameters. DP2 is the first square on the board, DP1 is the square holding the "current mover", DP4 is the position of "from" and DP5 is the position of "to". ■

Program 1.

```
  0 REM RNBKQBNR■■■■■■■■VAL PRI
NT LN PRINT ■ LET NOT AT UTAN LN
 ■INKEY$■?■77( PRINT TAN PRINT F
AST AT LN PRINT ■■ LET NOT ( CL
EAR TAN " "VAL LN PRINT ■■■:NOT
 ( CLEAR AT ■Y?■4 INPUT ■■LN PR
INT ■)■RND■■ LN ?"5■ FAST YPLN
■RND■■ LPRINT 8 FAST VAL ■LN ■RN
DAT LPRINT ( PRINT 8 FAST Y■LN ■
RND LPRINT 8??LN PRINT ■)■RND■■
LN ?"YA■■:LN ■RND$ RETURN I4 SAU
E Y1■£■LN ■RND■ RETURN 94 SAVE L
N ■RNDTAN 3456789012345678901234
567890123456789O
   3 REM 12345678901234567890123
4567890123456789012345678901234:
6/■:?/■:■/■:?■ EERND■TAN 6789012
34567890123456789O
   4 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   5 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   6 REM 12345670901234567890123
4567890123456789O1234
   9 RAND USR 16570
  10 FOR A=16780 TO 17087
  11 INPUT B
  12 POKE A,B
  13 PRINT AT 1,0;A
  15 NEXT A
  20 FOR A=16514 TO 18000
  21 SCROLL
  22 PRINT A,PEEK A
  23 NEXT A
```

Figure 1.



Figure 2.

```
 1■REM *** LOTS OF SPACES ***
 9 RAND USR 16570
10 FOR A=16514 TO 17087
11 INPUT B
12 POKE A,B
13 PRINT AT 1,0;A
15 NEXT A
```

Figure 3.

```
  0■REM 12345678901234567890123
45678901234567890123456789012345
67   89012345678901234567890l234
5678901234567890
   2 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   3 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   4 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   5 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
   6 REM 12345678901234567890123
4567890123456789O1234
```

Figure 4.

```
16514
 55  51  39  48  54  39  51  55
183 179 167 176 182 167 179 183
197 245 205 245   8 241 215 193
 60 201 205 140  65   6  90 126
254   0  32   2  54 128  35  35
16554
 16 245 201 245 229 193 205 245
  8   6   8 241 215  16 253 201
  1   0   2 197 205 245   8  62
  8   6  14 215  16 253 193   4
 62  15 184  32 238   1   2   4
16594
205 245   8  17 130  64   1   8
  0 205 107  11  33   2   5 229
 62  53 205 173  64   6   4 225
 36 229 197 175 205 173  64 193
225  16 245  36 229  62 181 205
16634
173  64 225  36  68  77 205 245
  8  17 138  64   1   8   0 205
107  11  62  38   1   9  14 205
146  64  13 254  46  32 248  62
 29   1  12   4 205 146  64   4
16674
254  37  32 248 205 156  64 201
```

Figure 5.

```
16780
                             14  34
 24  10  14  15  24   6  14 180
 24   2  14 195   6   0  42  12
 64   9 201
```

Figure 6.

```
  0■REM RNBKQBNR■■■■■■■■VAL PRI
NT LN PRINT ■ LET NOT AT UTAN LN
 ■INKEY$■?■77( PRINT TAN PRINT F
AST AT LN PRINT ■■ LET NOT ( CL
EAR TAN " "VAL LN PRINT ■■■:NOT
 ( CLEAR AT ■Y?■4 INPUT ■■LN PR
INT ■)■RND■■ LN ?"5■ FAST YPLN
■RND■■ LPRINT 8 FAST VAL ■LN ■RN
DAT LPRINT ( PRINT 8 FAST Y■LN ■
RND LPRINT 8??LN PRINT ■)■RND■■
LN ?"YA■■:LN ■RND$ RETURN I4 SAU
E Y1■£■LN ■RND■ RETURN 94 SAVE L
N ■RNDTAN 3456789012345678901234
567890123456789O
   3 REM 12345678901234567890123
4567890123456789012345678901234:
6/■:?/■:■/■:?■ EERND■TAN 6789012
34567890123456789O
   4 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
8901234567890
```

ATOM

Bank managers in cupboards are a thing of the past. Nigel Haughton's bank account program helps monitor your overdraft.

WHEN IT COMES to arithmetic, I have long resigned myself to using my four-bit brain, which makes heavy weather of numbers larger than 15, and crashes at the sight of a £ sign.

In order to restore some cordiality to relations with my bank manager, I decided to transfer my financial records to a machine more reliable at handling figures.

This handles a cheque-book bank account, maintaining a continually-updated statement of 24 entries, and presenting a working page of the eight most recent entries on the screen. Daily transactions may be entered with a short note, such as a cheque number, for reference, and regular standing orders — debit — or transfers — credit — are included and inserted automatically as encountered.

The window in the screen page may be scrolled up the statement to view the previous 16 entries, as desired. At any stage a table of the standing orders and transfers may be displayed and optionally modified before transactions are continued.

The statement may be saved on tape and reloaded at a later date for further transactions. Any number of accounts may be handled individually in this way.

Machine requirements are an Acorn Atom with EPROM 5K text RAM and 6K graphics RAM.

The following syntax has been used to explain the following operation of the program: contents of {} parentheses are optional, and may be omitted. Contents of [] parentheses are mandatory keyboard entries. Contents of <> parentheses refer to specific keys, for example, <Break>.

Note that the parentheses themselves should not be typed.

Characters preceded by a ˆ character for example, ˆR, are typed as shifted keys, and displayed as inverse characters. Although the program as listed has a good sprinkling of spaces, it should be typed in with all unnecessary spaces omitted.

Type in, Save, and then Run the program in the normal fashion as explained in the Atom handbook. The screen will display the title

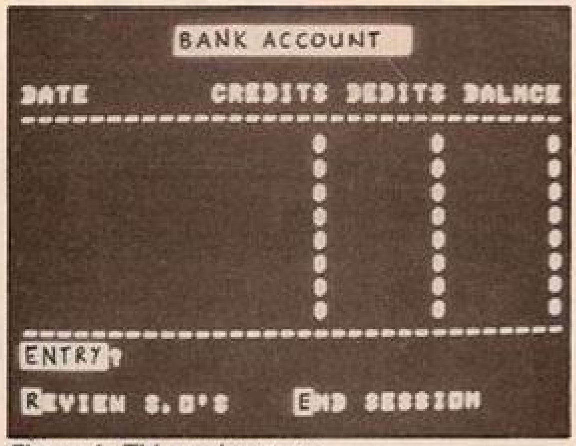


Figure 1. Title and prompt.



Figure 2. Table of SOs and transfers.

Bank Account and after a pause, the prompt Play Tape.

The first time an account is set up, answer the Play Tape prompt by typing <ESC> and [Goto 410 <Return>].

The statement page will be displayed with zeros in the Credit, Debit and Balance columns and a blank date at the top RHS of the statement — figure 1. At the bottom of the screen will be printed the prompts

ˆREVIEWS SO'S ˆEND SESSION

Type îR to display an empty table of standing orders and transfers. Meanwhile at the bottom of the screen will be printed the prompts

ˆREVISE SO'S ˆEND SO'S

Type ˆR again to display the prompt Date, Amount<ˆD/ˆC>? towards the top of the screen. At the bottom of the screen will be printed the prompt

ˆREVIEW SO'S

To enter a standing order or transfer, type the day of the month the transaction is to be made and the amount in the format

[Day Number,]{—}[amount in pounds]{ˆN}[ˆC or D]

The optional ˆN code — for New — is a signal that the amount is to replace an amount previously assigned to that day. If omitted, the amount will be subtracted from or added to the current amount, depending on whether the {—} is included or not.

The terminating code ˆC or ˆD signals that the value is to be treated as a transfer credit or standing order debit respectively. Note that although entered in pounds, all amounts are displayed in pence. For example, to replace

Listing for Atom Account.

```
10 REM*ACCOUNT*
20 REM*Copyright N.HAUGHTON August 1982*
30 X=31*4;Y=25*4
40 F=#8200;G=F+Y;H=G+Y;I=H+Y;J=I+X;Q=J+X;C=Q+Y
50 F.N=OTO Y+4 S.4;C=C+11;Q!N=C;$Q!N="";N.
60 F.N=OTO Y S.4;F!N=0;G!N=0;H!N=0;N.
70 F.N=OTO X S.4;I!N=0;J!N=0;N.
80 D=C+11;E=D+9;U=E+9;V=U+26;W=V+9;B=W+21;L=B+11
90 $D="";$E="";$U="";$V="";$W=""
100 $B="          ";$L="----------------"
110 DIM O41,25
120 $O="ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789,./:="
130 $Z="cder'"
150 DIM LL8,RR5;F.N=OTO8;LLN=-1;N.;F.N=OTO5;RRN=-1;N.
155 P.$21;F.N=1TO2;DIM P-1
160 [:LL0 LDA@#40;LDY@0
170 :LL1 STA(#96),Y;INY
180 CPY#9A;BNE LL1;RTS
190 :RR0 LDY@0
195 :RR1 JSR#FFE3;CMP@CH"@";BNE RR2
200 JSR LL0;LDA#80;STA#E0
205 LDA@7;JSR#FFF4;JMP RR0
210 :RR2 LDX@254
215 :RR3 INX;CPX@L.O;BEQ RR4
220 CMP O,X;BNE RR3
225 STA U,Y;JSR #FFF4
230 INY;JMP RR1
235 :RR4 LDX@254
240 :RR5 INX;CPX@L.Z;BEQ RR1
245 CMP Z,X;BNE RR5
250 STA U,Y;LDA@13;INY
260 STA U,Y;RTS
310 :LL2 LDY@32;LDX@0
320 :LL3 LDA(#90),Y;STA(#90,X)
330 CLC
340 LDA#90;ADC@1;STA#90
350 LDA#91;ADC@0;STA#91
360 LDA#90;CMP#92;BNE LL2
370 LDA#91;CMP#93;BNE LL2
380 JSR LL0;RTS
381 :LL4 LDA@#80;STA #90;STA #91
382 LDA@#5F;STA #92;LDA@#81;STA #93
383 LDX@0;LDY@32
384 :LL5 LDA(#92,X);STA (#92),Y
385 LDA #92;CMP #90;BNE LL6
386 LDA #93;CMP #91;BNE LL6;JSR LL0;RTS
387 :LL6 SEC
388 LDA #92;SBC @1;STA #92;BCS LL5
389 LDA #93;SBC @0;STA #93;JMP LL5
390 :LL7 JSR#FFE3;CMP@CH"r";BEQ LL8;CMP@CH"e";BNE LL7
391 :LL8 STA U;RTS;]
392 N.;P.$6
393 P.$12;?#E1=0;P.$8"bank"$253"account"$253"'$B$L+4
395 R=64
400 GOS.f;?#E1=0
410 GOS.a
420 DO !#DE=#81A0;?#9A=26;!#95=#81A6;?#80=6
430 P."entry?";LI.LL0;LI.RR0
435 IF $U="";IF R;GOS.1;U.0
436 IF R=0 OR R=32;R=96;GOS.1
440 IF$U="e"G.h
450 IF$U="r"GOS.g;GOS.a;U.0
460 K=L.U;Y=U?(K-1);IFY<>CH"c"IFY<>CH"d"P.$7; U.0
470 GOS.b
480 U.0
490h$E=$D;GOS.e
500 END

510aP.$12;?#E1=0;?#E0=9;?#8000=#40;P."statement"$253"date"
    $D" "

520 P.'''DATE      CREDITS DEBITS BALNCE"$L$L
530 @=7
540 F.X=68TO965.4
550 P.$Q!X;?#E0=11;P.F!X,G!X,H!X
560 N.
570 P.$L$L
580 GOS.w
590 R.

600bC=-1;A=C;$W=""
610rDO C=C+1;U.U?C=CH","OR C=K
620 DO A=A+1;U.(U?A>CH"9"AND U?A<CH"[")OR A=K
630 IF C=0;$U=$U+1;K=K-1;GOS.r;R.
640 IF C<K $V=$U+C+1;$U+C="";IF A<C;IF A;$W=$U+A;$U+A=""
650 IF C<K;IF A=0;$W=$U;$U=$D
660 IF C<K$D=$U;N=4*V.D;N=4*V.E;IF A=0;IF A<>C;N=N-4
```

ACCOUNT

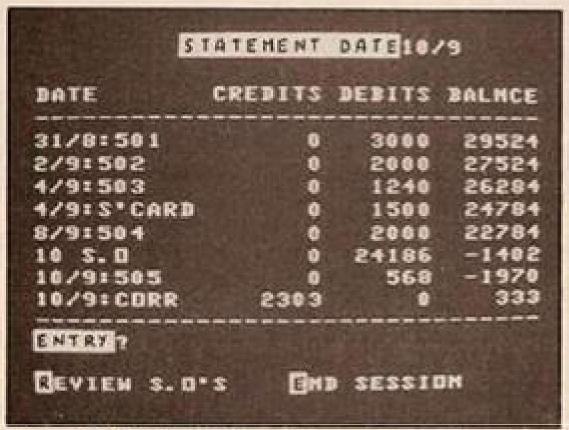


Figure 3. Statement page.

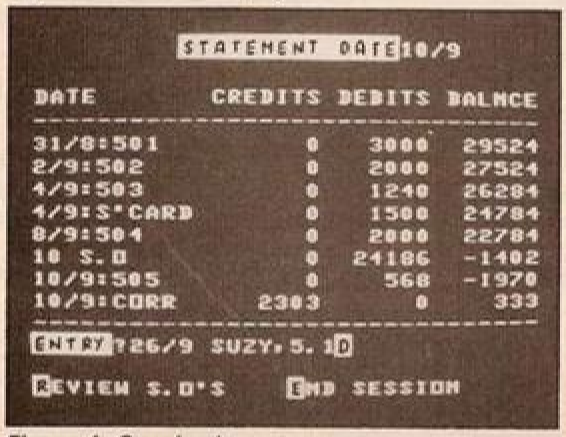


Figure 4. Suzy's cheque.

the amount credited on the 10th of the month with £10.50, type

[10,10.5^N^C]

To increase the amount debited on the 23rd of the month by £15.25, type

[23,15.26^D]

To overcome an error, type <@> and re-do the entire entry. The erroneous entry will be ignored.

To review the table of standing orders and transfers at any time, type ^E, as figure 2. Type ^R again to resume entering SOs and transfers. When all standing orders and transfers have been entered to your satisfaction, type ^E repeatedly until the statement page is once again displayed on the screen.

Answer the initial prompt Play Tape by starting playback of the appropriate data tape and immediately pressing an alphanumeric key. After a few moments the statement page previously saved will be displayed as in figure 3. Note again that all amounts are displayed in pence. New entries may now be typed in — note that entries must be in chronological order as the month number is not significant, and no sorting of the day numbers is done. For example, if an entry for 20/3 is typed in after an entry for 21/3, the 20/3 will be taken to refer to the following month and any standing orders or transferrs between the 21st and the following 20th will be inserted in the statement.

Entries are made in the formats.

{Day of month/Month number}{Note}[,amount in pounds][^C or ^D]

or

[amount in pounds][^C or ^D]

No <return> is neccessary.

If the optional date is omitted, the current statement date at the top RHS of the statement, which is also the date of the last entry made, will be adopted as the new date. This format should be used when a number of transactions are to be entered with the same date. The date and note together are truncated to 11 characters in total — allowing five or six characters for the note. If the optional date and note are both omitted, the second format should be used.

The terminating codes ^C or ^D signal whether the amount is a credit or a debit respectively.

For example, if you paid Suzy a cheque for £5.10 on July 26, type;

[26/7 SUZY,5.1^D]

as in figure 4. Or if you do not wish others to know about Suzy, type

[26/7,5.1^D]

If the previous entry was already dated the 26/7, type

[SUZY,5.1^D]

or

[5.1,^D]

respectively, instead.

Typing a <@> character signals that the entry typed so far contains an error and is to be ignored. A beep will sound and the entry will be erased — retype the entry from the beginning. If you complete an entry containing a syntactical error it will either be trapped and ignored — a beep will sound and the entry erased — or the entry will be entered on to the statement as a dummy zero amount with no effect on the balance.

Any standing orders or transfers encountered on the SO table between the previous and new entry dates will be inserted on the statement page before the entry just made.

You may review and revise the table of standing orders and transfers at your leisure by following the prompts at the bottom of the screen.

The screen window may be scrolled up the imaginary statement in blocks of eight entries at a time, by typing ^ . This is cyclic — that is, the window will be scrolled past the earliest entry on the statement back to the latest entry and then back to where you started from. A beep will sound to remind you that you are once again viewing the working page. If a new entry is made while an earlier portion of the statement is in the window, the screen will automatically revert to the working page before dealing with the new entry.

When the last entry has been made, type ^E to save the displayed statement and the table of standing orders and transfers on tape.

In answer to the prompt Record Tape, start the tape at the point where you wish to save the data and press an alphanumeric key. The values associated with the statement page and standing orders table will be recorded on tape and the message Statement Page Saved printed at the foot of the statement on the screen. ■

```
670 IF C<K;IF A;GOS.d
680 IF C=K$V=$U;$U=$D
690 !#DE=#8017;P.$D$B-3
700 $Q!100=$U;$Q!100+LEN(Q!100)=$W;$Q!100+11=""
710 Y=V?(L.V-1);%V=100*V.V
720 IF Y=CH"c"G!100=0;F!100=%V;H!100=H!96+F!100
730 IF Y=CH"d"F!100=0;G!100=%V;H!100=H!96-G!100
740 F.X=4TO96S.4;T=X-4;$Q!X=$Q!T;F!X=F!T;G!X=G!T;H!X=H!T;N.
760 !#90=#8080;!#92=#8160;!#96=!#92;?#9A=11;?#80=6
770 WAIT;LI.LL2
780 !#DE=#8160;P.$Q!96;?#E0=11;P.F!96;G!96;H!96
790 R.
800cP.$12;?#E1=0;P.$B+2"standing"$255"orders"
810 P.$L$L
820 DO
830 P.'"DATE,AMOUNT<d/c>?";!#80=!#DE;GOS.u;!#DE=!#80
840 !#96=!#DE+17;?#9A=15;?#80=17;LI.RR0;IF$U="e";G.j
850 C=0;DO C=C+1;U.U?C=CH","OR C=L.U
860 IF C=L.U;U.0
870 $V=$U+C+1;$U+C=""
880 N=4*V.U;Y=L.V-1
890 IF V?Y=CH"d"I!N=I!N*(V?(Y-1)<>CH"n")+%(100*V.V)
900 IF V?Y=CH"c"J!N=J!N*(V?(Y-1)<>CH"n")+%(100*V.V)
910jU.$U="e"
920gP.$12;?#E1=0;P.$B+2"STANDING ORDERS"''$B+4"DATE:TRANS-
    FERS:"
930 P." S.ORDERS"'
940 P.$L$L
950 @=10;F.N=4TO124S.4;IF I!N OR J!N;P.'N/4,J!N,I!N
960 N.;P.'$L$L
970 GOS.x
980 LI.LL7
990 IF?U=CH"r"G.c
1000 GOS.a
1010 R.
1020dDO
1030 DO N=N+4;IF N/4>31 N=4
1040 U.I!N OR J!N OR (N=M);IF I!N=0 AND J!N=0 G.k
1050 F.X=4TO92S.4;T=X+4;$Q!X=$Q!T;F!X=F!T;G!X=G!T;H!X=H!T;N.
1070 G!96=I!N;F!96=J!N;H!96=H!92-I!N+J!N
1080 STR N/4,Q!96;$Q!96+2="";IF N<10;$Q!96+1=""
1090 IF J!N;$Q!96+L.(Q!96)=" TFR"
1100 IF I!N;$Q!96+L.(Q!96)=" S.O"
1110 !#90=#8080;!#92=#8160;!#96=!#92;?#9A=11
1120 WAIT;LI.LL2
1130 !#DE=!#92;P.$Q!96;?#E0=11;P.F!96,G!96,H!96
1140kU.N=M;$E=$D
1150 R.
1160eGOS.s;!#DE=#800081A0
1170 S=FO.""
1180 SP.S,D;F.N=4TO124S.4;PUT S,I!N;PUT S,J!N;N.
1190 F.N=4TO96S.4;SP.S,Q!N;PUT S,F!N;PUT S,G!N;PUT S,H!N;N.
1200 P.$11"statement"$255"page"$255"saved";R.
1210f!#DE=#800080A8;?#8036=#40
1230 S=F.""
1240 S.S,E;F.N=4TO124S.4;I!N=G.S;J!N=G.S;N.
1250 F.N=4TO96S.4;S.S,Q!N,F!N=G.S;G!N=G.S;H!N=G.S;N.
1260 IF V.E=0 DOSE=$(E+1);U.V.E
1270 $D=$E
1280 R.
1290u!#DE=#81E0;P."ReVIEW S.O'S"$B$B+2;R.
1300w!#DE=#81E0;P."rEVIEW S.O'S   eND SESSION";R.
1310x!#DE=#81E0;P."rEVISE S.O'S   eND S.O'S";R.
1320z!#96=#81A0;!#9A=96;WAIT;LI.LL0;R.

1400l@=7;!#9A=11;!#96=#8080
1410 F.N=R TO R-28 S.-4
1420 !#DE=#8080;LI.LL4
1430 P.$Q!N;?#E0=11;P.F!N,G!N,H!N
1440 N.
1450 R=N;R.
```



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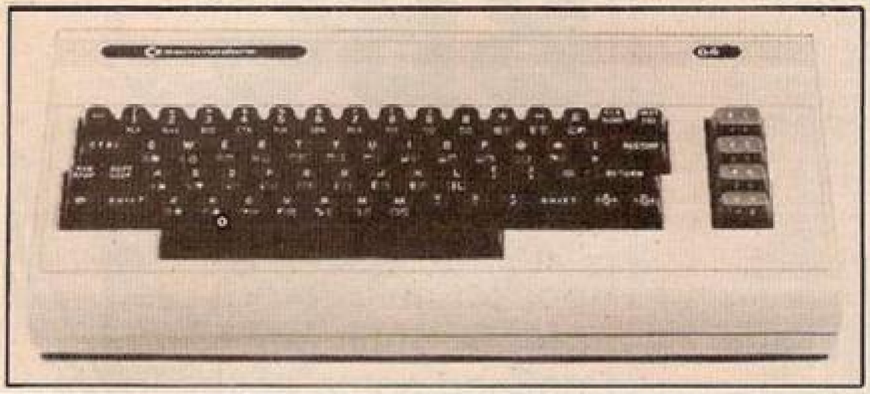
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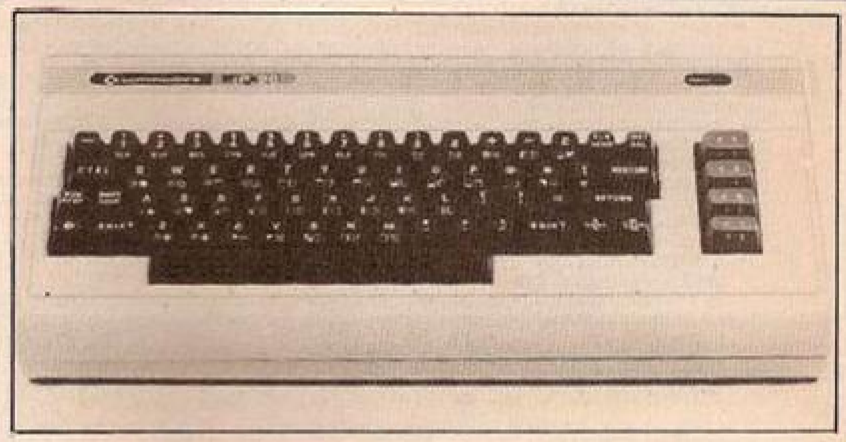
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Dragon 32 computer hardware







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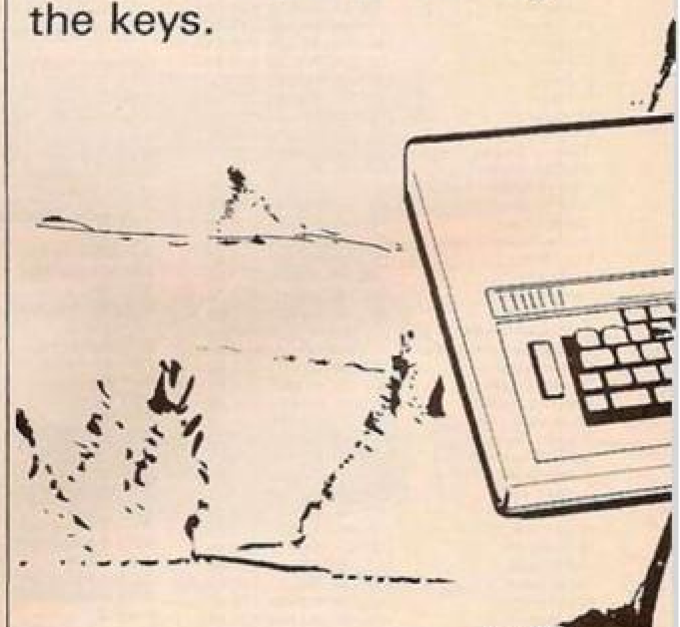
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```
1 ON ERROR GOTO149
   2*TV255
   3MODE7:PROCINITIALISE:PROCINST:PROCPICTURE
   4PROCCURSOR
   5ON 0%-48 GOTO 7,9,14,29,37,45,48,52,67,78
   6REM  ** ENTER KEY ROUTINE **
   7SOUND0,-10,2,4:PROCSHADEKEY(KEY%,146):N%=N%+1:N%(N%)=LOWC%+(OCTAVE%*12-13+K
EY%)*4:PROCINFO:PROCWAIT(50):GOTO4
   8REM ** DELETE KEY ROUTINE **
   9IF N%=0 SOUND0,-10,1,4:PRINTTAB(0,21)::VDU141,136:PRINT"No key to delete":T
AB(0,22)::VDU141,136:PRINT"No key to delete":PROCWAIT(400):PROCWIPE:GOTO4
   10SOUND0,-10,2,4:N%=N%-1:FORI%=10 TO 18:PRINTTAB(30,I%):SPC9:NEXT:PROCINFO
   11PRINTTAB(0,21)::VDU141,136,131:PRINT"Last entered key has been deleted":TAB
(0,22)::VDU141,136,131:PRINT"Last entered key has been deleted":X=INKEY(300)
   12PROCWIPE:GOTO4
   13REM ** COPY A SECTION ROUTINE **
   14IF N%=0 SOUND0,-10,1,4:PRINTTAB(0,21)::VDU141,136:PRINT"No notes to copy":T
AB(0,22)::VDU141,136:PRINT"No notes to copy":PROCWAIT(400):PROCWIPE:GOTO4
   15SOUND0,-10,2,4:PRINTTAB(0,21):"You can now copy a section of previouslyente
red notes onto your current positionby specifying the nos. of the bounding  note
s"::X=INKEY(400)
   16PROCWIPE
   17INPUTTAB(0,22)"NO. OF FIRST NOTE (INCLUSIVE) ?",D%:IFD%>N% OR D%<1 PROCWIPE
:GOTO17
   18INPUTTAB(0,22)"NO. OF SECOND NOTE (INCLUSIVE) ?",E%:IFE%>N% OR E%<1 OR E%<D
% PROCWIPE:GOTO18
   19 IF N%+E%-D%+1>MAXNOTES% PROCWIPE:SOUND0,-10,1,4:PRINTTAB(0,21)::VDU141,136
:PRINT"Out of storage range":TAB(0,22)::VDU141,136:PRINT"Out of storage range":P
ROCWAIT(400):PROCWIPE:GOTO4
   20PROCWIPE:SOUND0,-10,2,4:PRINTTAB(0,21)::VDU141,136:PRINT"COPYING":TAB(0,22)
::VDU141,136:PRINT"COPYING"
   21FORI%=D%TOE%:CKEY%=(N%(I%)-LOWC%)MOD48DIV4+1:COCTAVE%=(N%(I%)-LOWC%)DIV48+1
   22PROCSHADEOCTAVE(COCTAVE%,130,131):PROCSHADEKEY(CKEY%,146)
   23SOUND1,-15,150,2:PROCWAIT(30)
   24IFCKEY%=2 ORCKEY%=4 ORCKEY%=7 ORCKEY%=9 ORCKEY%=11 PROCSHADEKEY(CKEY%,148)
ELSEPROCSHADEKEY(CKEY%,150)
   25PROCSHADEOCTAVE(COCTAVE%,134,134)
   26N%=N%+1:N%(N%)=N%(I%):PROCINFO:NEXTI%
   27PROCWIPE:GOTO4
   28REM ** BLOCK DELETE ROUTINE **
   29IF N%=0 SOUND1,-15,30,4:PRINTTAB(0,21)::VDU141,136:PRINT"No notes to delete
":TAB(0,22)::VDU141,136:PRINT"No notes to delete":PROCWAIT(400):PROCWIPE:GOTO4
   30SOUND1,-15,100,4:PRINTTAB(0,21):"You can now delete a block of previouslyen
tered notes.Specify the two bounding  notes by their numbers."::X=INKEY(500)
   31PROCWIPE
   32INPUTTAB(0,22)"NO. OF FIRST NOTE (INCLUSIVE) ?",D%:IFD%>N% OR D%<1 PROCWIPE
:GOTO31
   33INPUTTAB(0,22)"NO. OF SECOND NOTE (INCLUSIVE) ?",E%:IFE%>N% OR E%<1 OR E%<D
% PROCWIPE:GOTO33
   34IF E%=N% N%=D%-1 ELSE FOR I%=E%+1 TON%:N%(D%+I%-E%-1)=N%(I%):NEXT:N%=N%-E%+
D%-1
   35FORI%=10 TO18:PRINTTAB(30,I%):SPC9:NEXT:PROCWIPE:PROCINFO:GOTO4
   36REM ** SOUND LAST NOTE **
   37IF N%=0 SOUND0,-10,1,4:PRINTTAB(0,21)::VDU141,136:PRINT"No last note to sou
nd":TAB(0,22)::VDU141,136:PRINT"No last note to sound":PROCWAIT(400):PROCWIPE:GO
TO4
   38PRINTTAB(0,21)::VDU141,136,131:PRINT"Sounding last note":TAB(0,22)::VDU141,
136,131:PRINT"Sounding last note"
   39CKEY%=(N%(N%)-LOWC%)MOD48DIV4+1:COCTAVE%=(N%(N%)-LOWC%)DIV48+1
   40PROCSHADEOCTAVE(COCTAVE%,130,131):PROCSHADEKEY(CKEY%,146)
   41SOUND1,-15,N%(N%),20:PROCWAIT(200)
   42IFCKEY%=2 ORCKEY%=4 ORCKEY%=7 ORCKEY%=9 ORCKEY%=11 PROCSHADEKEY(CKEY%,148)
ELSEPROCSHADEKEY(CKEY%,150):PROCSHADEOCTAVE(COCTAVE%,134,134)
   43PROCWIPE:GOTO4
   44REM ** SOUND CURSOR NOTE **
   45PRINTTAB(0,21)::VDU141,136,131:PRINT"Sounding cursor":TAB(0,22)::VDU141,136
,131:PRINT"Sounding cursor"
   46SOUND1,-15,LOWC%+(OCTAVE%-1)*48+(KEY%-1)*4,20:PROCWAIT(120):PRINTTAB(0,21):
SPC80::GOTO4
   47 REM ** SELECT SOUND OPTION**
   48PRINTTAB(0,21):"Hit C if you want the cursor to produce a beep every note-c
hange,or S to ensure its silence unless you use F5":
   49REPEAT:F$=GET$:UNTIL F$="S" ORF$="C"
   50PRINTTAB(0,21):SPC(120)::GOTO4
   51REM **REVIEW ROUTINE**
   52IF N%=0 SOUND1,-15,30,4:PRINTTAB(0,21)::VDU141,136:PRINT"No notes to review
":TAB(0,22)::VDU141,136:PRINT"No notes to review":PROCWAIT(400):PROCWIPE:GOTO4
   53SOUND1,-15,100,4:PRINTTAB(0,21):"REVIEW FUNCTION-hit one of the followingF,
M,S-Fast,Medium or Slow run through ofnotes,with accompanying sound          R-
you tap the Rhythm on RETURN key"::*FX15,0
   54REPEATG$=GET$:UNTILG$="F"ORG$="M"ORG$="S"ORG$="R"
   55IFG$="F"H%=0 ELSE IF G$="M" H%=50 ELSE IF G$="S" H%=100 ELSE H%=-74
   56PROCWIPE:PRINTTAB(0,21):"Hit V for visual only"'"    S for sound only"'"
 B for both"'"Note that V or B will be more sluggish":
   57REPEAT:H$=GET$:UNTIL H$="S" ORH$="B" ORH$="V"
   58PROCWIPE:PRINTTAB(0,21):CHR$131:CHR$141:CHR$137:"Reviewing notes":TAB(0,22)
:CHR$131:CHR$141:CHR$137:"Reviewing notes"
   59FORI%=1TON%:IFH$="S" GOTO61 ELSECKEY%=(N%(I%)-LOWC%)MOD48DIV4+1:COCTAVE%=(N
%(I%)-LOWC%)DIV48+1
   60PROCSHADEOCTAVE(COCTAVE%,130,131):PROCSHADEKEY(CKEY%,146)
   61PROCINFO:IF H$<>"V" SOUND&11,-15,N%(I%),10
   62REPEAT:X%=INKEY(H%):UNTILX%<>0
   63IFH$="S"GOTO65 ELSEIFCKEY%=2 ORCKEY%=4 ORCKEY%=7 ORCKEY%=9 ORCKEY%=11 PROCS
HADEKEY(CKEY%,148) ELSEPROCSHADEKEY(CKEY%,150)
   64PROCSHADEOCTAVE(COCTAVE%,134,134)
   65NEXT:PRINTTAB(0,21):SPC80::PROCWAIT(100):GOTO4
   66 REM** INSERT ROUTINE **
   67IF N%=0 SOUND0,-10,1,4:PRINTTAB(0,21)::VDU141,136:PRINT"Nowhere to insert":
TAB(0,22)::VDU141,136:PRINT"Nowhere to insert":PROCWAIT(400):PROCWIPE:GOTO4
   68SOUND0,-10,2,4:PRINTTAB(0,21):"INSERT MODE :- you may now insert notes into
 those already entered."::X=INKEY(300):NN%=N%
   69PROCWIPE:PRINTTAB(0,21):"Enter the note after which you want to  insert mor
e notes (give its position in the sequence)"::INPUTD%:IF D%>N% ORD%<0 GOTO69
   70PROCWIPE:INPUTTAB(0,21)"Enter position within octave of new note(1-12,or 0
to finishinserting)",NKEY%:IFNKEY%<0 OR NKEY%>12 GOTO70
   71IFNKEY%=0 PROCWIPE:PRINTTAB(0,20):SPC38:PROCINFO:GOTO4
   72INPUTTAB(0,23)"Enter octave of new note ",NOCTAVE%:IFNOCTAVE%<0 OR NOCTAVE%
>5 GOTO72
   73IFNOCTAVE%=0 PROCWIPE:PRINTTAB(0,20):SPC38:PROCINFO:GOTO4
   74FORI%=N%TOD%+1 STEP-1:N%(I%+1)=N%(I%):NEXT:N%=N%+1:N%(D%+1)=LOWC%+(NOCTAVE%
-1)*48+(NKEY%-1)*4
   75PRINTTAB(0,20):CHR$134:"Next one in at:":CHR$131:D%+1:TAB(22,20):CHR$134:"N
o. inserted:":CHR$131:N%-NN%:
   76PROCINFO:D%=D%+1:GOTO70
   77 REM ** TUNE-UP ROUTINE **
   78SOUND0,-10,2,4:PRINTTAB(0,20):"TUNE-UP :":CHR$135:"You can tune thw compute
r by  changing the pitch produced by the left-most note,C (1).This is initially
set at5 units (this produces middle-c at C (2)).(KEY TO GO ON...)":
   79X=GET
   80PRINTTAB(0,20):SPC198:TAB(0,20):"C (1) can be given an integer value of  be
tween 0 and 17 (note that 4 units=one semitone).You can move the cursor  and  us
e F5 (Sound cursor) to compare a note to another instrument.  (KEY....)":
   81X=GET
```

MORE FROM BBC

Tired of composing symphonies on your pocket calculator? Last month Chris Melville defined some of the initial difficulties encountered in turning the BBC into a musical instrument. This month, his program takes the tedium out of tickling the keys.



NEARLY EVERYONE has seen a pocket calculator-cum-keyboard which allows the user to enter a tune and play it back at various speeds. Of course, to get the BBC Micro to play a tune the process would be much more laborious. First you have to define an envelope if required then each musical note must be changed to a corresponding integer for use in the pitch part of the sound statement. Next, each musical note must be given a duration parameter, as well as some number telling the computer when to sound it. All of these numbers need to be keyed-in by hand. The computer also needs a routine to sound the correct note at the correct time.

This is all very boring, repetitious and error-prone since the BBC Micro has no musical keyboard and all notes have to be entered as numerical data. To produce a tune-playing

MUSIC THE



computer without all of these problems, I have written the program Keyboard included in this article. The instructions are again separate. The user can enter the notes comprising the tune by means of a cursor which can be moved up and down a musical keyboard drawn in colour on a Mode 7 screen.

Once all of the notes have been entered, the user taps out the rhythm of the tune on function key. One can change the speed if required. This is useful for entering fast bits which would be hard to tap out correctly at the right speed. The computer matches up the notes to the rhythm and, at the touch of a button, plays the whole tune at the correct spacings and speed.

Because Keyboard uses Mode 7, thus only 1K video RAM, it will run on a Mode 1A,

(continued on page 77)

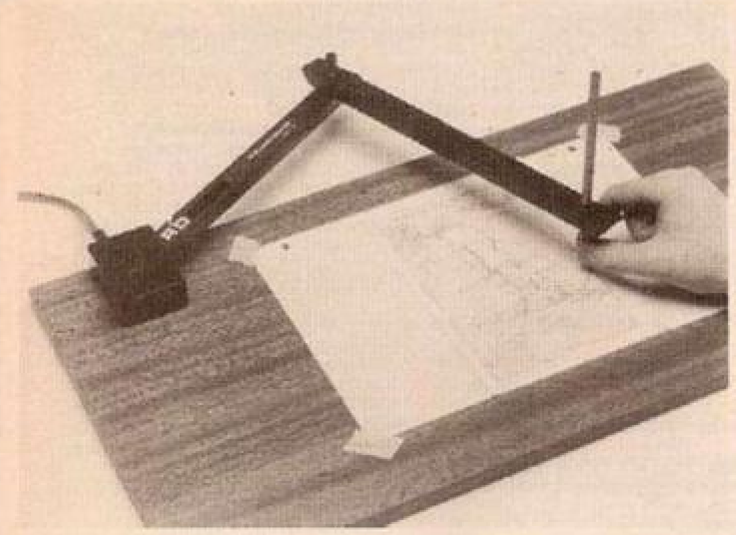
```
   82PRINTTAB(0,20):SPC198:TAB(0,21):CHR$134"Current value of C (1):":CHR$131:LO
WC%
   83INPUTTAB(0,23)" Choose new value " NLOWC%:IF NLOWC%>17 OR NLOWC%<0 GOTO82 E
LSE LOWC%=NLOWC%
   84PROCWAIT(50):PRINTTAB(0,20):SPC198:GOTO4
   85DEF PROCSHADEOCTAVE(OCTAVE%,A%,B%):PRINTTAB((OCTAVE%-1)*7+1,1);:VDUA%,157,B
%:PRINTTAB((OCTAVE%-1)*7+1,2);:VDUA%,157,B%:ENDPROC
   86DEF PROCPICTURE:FORI%=1 TO2:PRINTTAB(0,I%);CHR$141
   87 FORJ%=1 TO29 STEP7:PRINTTAB(J%,I%);
   88 VDU134,157,134,J%DIV7+49,J%DIV7+49,J%DIV7+49,158:NEXT:VDU158,156:NEXT
   89FORI%=5 TO13:PRINTTAB(0,I%);
   90VDU153,150,255,158,148,158,150,158,148,158,150,255,158,150,255,158,148,158,
150,158,148,158,150,158,148,158,150,255,255,159:NEXT
   91FOR I%=14 TO19:PRINTTAB(0,I%);CHR$153;CHR$150;
   92FOR J%=2 TO26 STEP4:VDU255,255,150,150:NEXT:PRINTTAB(29,I%);CHR$159:NEXT
   93PRINTTAB(1,0);:VDU130,157,136,135:PRINT"Present octave is:";SPC14;CHR$156
   94PRINTTAB(2,4);CHR$(131);"C C£D D£ E  F F£G G£A A£ B"
   95ENDPROC
   96DEF PROCINITIALISE:LOCAL I%
   97*KEY0 1
   98*KEY1 2
   99*KEY2 3
  100*KEY3 4
  101*KEY4 5
  102*KEY5 6
  103*KEY6 7
  104*KEY7 8
  105*KEY8 9
  106*FX4,1
  107OCTAVE%=1:KEY%=1:LOWC%=5:N%=0:MAXNOTES%=200:F$="C":RESTORE:DIM COLPOS%(12),
WNOTE$(12),N%(MAXNOTES%)
  108FORI%=1 TO12:READCOLPOS%(I%),WNOTE$(I%):NEXT
  109DATA101,"C ",400,C£,605,"D ",800,D£,1009,"E ",1313,"F ",1600,F£,1817,"G ",2
000,G£,2221,"A ",2400,A£,2625,"B "
  110VDU23;8202;0;0;0;:ENDPROC
  111DEF PROCSHADEKEY(KEY%,SHADE%):LOCALI%
  112FOR I%=5 TO13:PRINTTAB(COLPOS%(KEY%)DIV100,I%);CHR$(SHADE%):NEXT
  113FOR I%=14 TO19:IF COLPOS%(KEY%)MOD100 <>0 PRINTTAB(COLPOS%(KEY%)MOD100,I%);
CHR$(SHADE%)
  114NEXT:ENDPROC
  115DEF PROCCURSOR
  116PROCSHADEOCTAVE(OCTAVE%,129,131)
  117LASTKEY%=KEY%:LASTOCTAVE%=OCTAVE%
  118IF F$="C" SOUND&11,-10,LOWC%+(OCTAVE%*12-13+KEY%)*4,5:PROCSHADEKEY(KEY%,149
) ELSEPROCSHADEKEY(KEY%,149)
  119REPEAT:*FX15,1
  120O%=GET:UNTIL O%=137 OR O%=136 OR (O%>48 AND O%<59)
  121IF O%<59 ENDPROC
  122IF O%=136 GOTO125
  123IF KEY%<>12 KEY%=KEY%+1 ELSE IF OCTAVE%=5 SOUND1,-15,30,3:GOTO119 ELSE KEY%
=1:OCTAVE%=OCTAVE%+1:SOUND1,-15,100,2:PROCSHADEOCTAVE(LASTOCTAVE%,134,134):PROCS
HADEOCTAVE(OCTAVE%,129,131)
  124GOTO126
  125IF KEY%<>1 KEY%=KEY%-1 ELSE IF OCTAVE%=1 SOUND1,-15,30,3:GOTO119 ELSE KEY%=
12:OCTAVE%=OCTAVE%-1:SOUND1,-15,100,2:PROCSHADEOCTAVE(LASTOCTAVE%,134,134):PROCS
HADEOCTAVE(OCTAVE%,129,131)
  126IF LASTKEY%=2 ORLASTKEY%=4 ORLASTKEY%=7 ORLASTKEY%=9 ORLASTKEY%=11 PROCSHAD
EKEY(LASTKEY%,148) ELSEPROCSHADEKEY(LASTKEY%,150)
  127 GOTO117
  128DEF PROCINFO:LOCALI%
  129PRINTTAB(30,5);CHR$131;"NOTES NOW";TAB(30,6);CHR$131;"ENTERED:-";TAB(32,7);
CHR$134;N%;"  ";
  130FOR I%=N% TO N%-2 STEP-1
  131 IF I%=0 I%=N%-2 ELSE PRINTTAB(30,10+(N%-I%)*3);CHR$131;"NOTE ";I%;"=";TAB(
32,11+(N%-I%)*3);CHR$134;WNOTE$((N%(I%)-LOWC%)MOD48DIV4+1);" (";(N%(I%)-LOWC%)DI
V48+1;")"
  132 NEXT:ENDPROC
  133DEF PROCWAIT(C%):TIME=0:REPEAT:UNTIL TIME>=C%:ENDPROC
  134DEF PROCWIPE:PRINTTAB(0,21);SPC158;:ENDPROC
  135DEF PROCINST
  136PRINT
  137CLS:PRINT"PLAYMUSIC program by Chris Melville '82 *************************
***************"
  138PRINT'CHR$131;"This program is in 2 parts,this is the"';CHR$131;"first part
-which deals with setting up"'CHR$131;"of an array containing (in order) the";'C
HR$131;"notes to be played."''CHR$134;
  139 PRINT"The next part,which deals with entering";CHR$134;"the rhythm of the
tune and playing it"'CHR$134;"back,should be recorded on tape after"'CHR$134;"th
is one since this one CHAINs it."
  140PRINT'CHR$130;"Full instructions are in the article to";CHR$130;"save space
."
  141PRINT''CHR$129;"Be sure you have finished entering all"'CHR$129;"the notes
before going on to the next"'CHR$129;"part (by pressing ESCAPE) since you "'CHR$
129;"cannot return to it intact."
  142PRINT''CHR$133;CHR$136;"     Hit a key to go on.....";:X=GET:CLS
  143PRINT"The functions available are:"''CHR$131;"F0:-enters the note on which
the purple"CHR$131;"    cursor is on as one to be played"''CHR$134;"F1:-deletes
the last note entered"''CHR$130;"F2:-repeats a section of notes"'
  144PRINTCHR$129;"F3:-deletes a block of notes"''CHR$133;"F4:-sounds the last n
ote entered"''CHR$132;"F5:-sounds the position of the cursor"''CHR$131;"F6:-enab
les/disables the cursors beep"'';CHR$134;
  145PRINT"F7:-audio/visual review of notes so far"'CHR$130;"F8:-can insert note
s into list"''CHR$129;"F9:-used to 're-tune' computer"''CHR$136;"Hit a key to st
art....";:X=GET:CLS
  146PRINTTAB(10,2);:VDU129,141,136:PRINT"Remember:";TAB(10,3);:VDU129,141,136:P
RINT"Remember:";TAB(0,10);CHR$131;"At the moment you are only entering the";CHR$
131;"notes,the rhythm/tempo comes in part 2";
  147PRINTTAB(0,17);CHR$134;"The purple key-cursor is moved by using";CHR$134;"t
he right + left cursor keys":PROCWAIT(800):CLS
  148ENDPROC
  149CLS:PRINTCHR$131;"Going on to next program"''CHR$130;"Start your cas
sette player now"'''CHR$134;CHR$136;"          ";
  150HIMEM=HIMEM-N%:FOR I%=1 TO N%:?(HIMEM+I%-1)=N%(I%):NEXT:PROCWAIT(250)
  151M%=MAXNOTES%:CHAIN""
>RUN
   10 ON ERROR MODE7:END
   11DIM N%(M%),T%(M%),D%(M%),A%(6),P%(8):FOR I%=1 TO N%:N%(I%)=?(HIMEM+I%-1):NE
XT:R%=0
   12RESTORE:FORI%=1 TO8:READ P%(I%):NEXT:FOR I%=1 TO6:READ A%(I%):NEXT:IF P%(2)
=0 P%(1)=P%(1)+127
   13DATA1,1,0,0,0,1,1,1,126,0,0,-20,126,126
   14*KEY0 1      16*KEY2 3
   15*KEY1 2      17*KEY3 4
   18ENVELOPE1,P%(1),P%(3),P%(4),P%(5),P%(6),P%(7),P%(8),A%(1),A%(2),A%(3),A%(4)
,A%(5),A%(6)
   19CLS:PRINT''CHR$136;"  You can now use F0,F1,F2,F3...."'''CHR$131;"
  F0) enter rhythm"''';CHR$133;"       F1) auto playback"''';CHR$134;"       F2)
 choose voice for F1)"''';CHR$129;"       F3) change speed of F1)"
   20PROCWAIT(200):SOUND0,-12,2,4:*FX15,1
   21PRINT'''CHR$136;CHR$130;CHR$141;"    C H O O S E   N O W ......."'CHR$136;C
HR$130;CHR$141;"    C H O O S E   N O W .......":*FX15,1
   22REPEAT:O%=GET-48:UNTIL O%>0 ANDO%<5:CLS:SOUND0,-15,2,4:ONO% GOTO 23,32,36,6
```

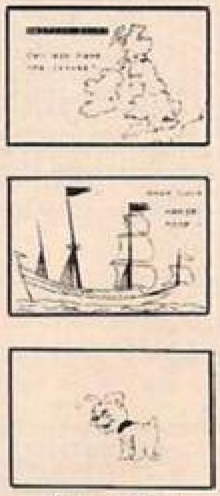
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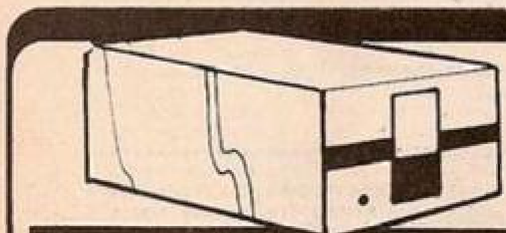
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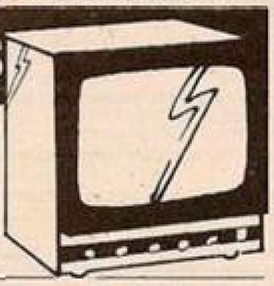
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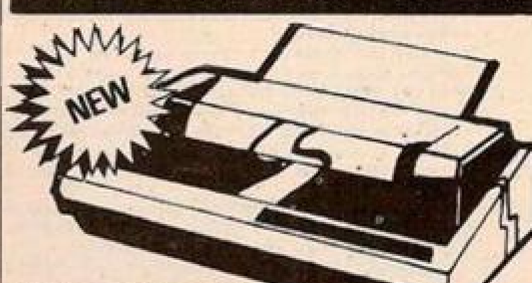
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although it cannot store as many notes as a Mode 1B. Note that Keyboard is in two parts, the first of which Chains the second — they must thus be recorded consecutively on tape.

Although the BBC's Envelope and Sound statements allow it to produce a wide variety of sound, the tonal quality of these sounds is not rich. This is because the sound chip fitted, SN76489, produces only square waves. These are the fundamental working signals inside your computer.

I have used my micro to produce sawtooth, sine, triangular waves. This involves a little bit of electronics. Roughly speaking, the problem is to create a voltage, external to the computer, which varies in a wave-form the same as that which we want to hear and, since the user port gives eight-bit digital output, all that is needed is an eight-bit digital-to-analogue converter (DAC) connected to the eight PB lines of the user port.

The user port is memory-mapped at location &FE60 so if we place the correct numbers here, then the digital-to-analogue converter will produce the voltage wave-forms needed to drive a speaker circuit. So the overall method is as follows: first work out the values that are to be fed to the user port and use byte in direction to store them consecutively in a spare page of memory. This can be done in Basic since speed is not important and functions such as sine can be used. Next use a machine-code routine to cycle through the relevant page of memory byte by byte, outputting to &FE60 as it goes. Then, the eight-bit DAC and the odd OA will do the rest and the resultant wave-form will be heard.

Program Keyboard for 16 or 32K provides the BBC Micro with a facility which enables it to learn a tune as a series of notes with their correct rhythm, and then play it back at a selected speed — all at the touch of one key.

The program is in two parts. The first, which deals with entering the notes, should be typed in and then Saved on tape. The second part should then be Saved after it, since it calls the second part using a Chain command. Stop the tape machine after loading the first program, if it does not have computer control.

The program functions in three parts: first, enter all notes — this is a routine, with useful editing features, which sets up an array containing the codes of all of the notes to be sounded, and in the correct order. The method of entry is to move a cursor up and down a musical keyboard on the Mode 7 screen and use the function keys to perform miscellaneous operations to make the job easier. This is contained in the first listing.

Next, enter rhythm — the user now merely taps out the tune using key F0 and/or F1 and the computer matches up each note with its position and timing information in real time.

The third part, auto-sound, enables selection of a voice and the computer plays the tune in that voice.

The tune is restricted to one note at a time, no chords. The use of the function keys is as follows:

Program 1

F0 Enter note	Enters the note currently covered by the cursor on to the list of notes to be played.
F1 Delete note	Deletes the last note to be entered from the list.
F2 Repeat over	Enables a block of notes already in the list to be repeated again at the end of the list.
F3 Block Delete	Enables a block of notes already entered to be deleted.
F4 Echo	Echoes the last note to have been entered.
F6 CSR Beep	Enables/disables the cursor from echoing its position at every move.
F7 Review	Will show and/or sound all notes thus far entered.
F8 Insert	Enables notes to be inserted between others already in the list.
F9 Re-tune	Used to tune the BBC to a different instrument.
Escape Key	Sends you on to the next recorded program.

Program 2

F0	Enter Rhythm; F0 and F1 then become input keys.
F1	Commence auto playback.
F2	Select voice F3 — adjust duration of tune.

The maximum number of notes possible is set by the variable Maxnotes % in line 110. You can adjust this value in accordance with the amount of RAM you have. ■

(continued from page 75)

```
2
   23R%=-1:PRINT'CHR$129:CHR$141:"      Rhythm  entering"'CHR$129:CHR$141:"
 Rhythm  entering"'CHR$148:"        ":STRING$(16,CHR$124)'''
   24 PRINTCHR$134:"You must now tap out the tune on F0/F1"'CHR$134:"The compute
r will match the taps with"'CHR$134:"the notes you have already entered.In"'CHR$
134:"the interests of accurate timing,the"'CHR$134:"computer will not pause to";
   25PRINT" sound out"'CHR$134:"the notes corresponding to your taps."'CHR$134:"
You will have to hum them in your head"'CHR$134:"as you go !!"''''CHR$136:CHR$1
33:"    T A P   A W A Y ! ! '....."
   26I%=1:*FX11,0
   27 T%(1)=0:*FX15,0
   28REPEAT:UNTIL INKEY(-33) ORINKEY(-114):TIME=0:REPEAT:UNTIL NOTINKEY(-33) AND
 NOTINKEY(-114):D%(1)=TIME
   29REPEAT:I%=I%+1:REPEAT:UNTIL INKEY(-33) ORINKEY(-114):T%(I%)=TIME:REPEAT:UNT
ILNOTINKEY(-33) AND NOTINKEY(-114):D%(I%)=TIME-T%(I%):UNTIL I%=N%
   30FORI%=1 TON%:D%(I%)=INT(D%(I%)/5+.5):IFD%(I%)>254 D%(I%)=255:NEXT ELSEIFD%(
I%)=0 D%(I%)=1:NEXT ELSE NEXT
   31PRINT''CHR$131:CHR$141:"       NOTE LIST ENDED"'CHR$131:CHR$141:"        N
OTE LIST ENDED"':SOUND1,-10,100,4:X=INKEY(400):GOTO19
   32IF FNNORHYTHM GOTO19 ELSEPRINTCHR$133:CHR$141:"         Auto-playback"'CHR$
133:CHR$141:"        Auto-playback"'CHR$145:"          ":STRING$(13,CHR$96)'''C
HR$131:"Hit RETURN to start the auto-playing of":CHR$131:"your tune."
   33I%=0: REPEAT:UNTIL INKEY(-74):TIME=0
   34REPEAT:I%=I%+1:REPEAT:UNTILTIME>=T%(I%):SOUND&12,1,N%(I%),D%(I%):UNTILI%=N%
   35GOTO19
   36PRINT''CHR$133:CHR$141:"       Select voice"'CHR$133:CHR$141:"         Se
lect voice"'CHR$145:"          ":STRING$(12,CHR$96)'''CHR$131:"You may now choos
e (by number) either"'CHR$131:"predefined pitch and amplitude sounds"'CHR$131;
   37 PRINT"or define your own."'''CHR$134:"The pitch section comes first,select
 by"CHR$134:"typing the appropriate number"'''CHR$130:"HIT A KEY TO START....":X
=GET
   38CLS:PRINT''CHR$133:CHR$141:CHR$136:"  Amplitude  selection......"'CHR$133:C
HR$141:CHR$136:"  Amplitude  selection......"'CHR$148:CHR$136:"   ":STRING$(20,C
HR$96)'''CHR$134:"Select (by number) one of these :"'
   39PRINTCHR$130:"0) sharp attack / gentle decay"'CHR$129:"1) sharp attack / sh
arp decay"'CHR$132:"2) gentle attack / sharp decay"'CHR$133:"3) gentle attack /
gentle decay"'CHR$134:"4) gentle attack / no decay"
   40PRINTCHR$131:"5) sharp attack / no decay"'" 6) define own amplitude section
"'CHR$130:"7) keep present amplitude section"'''CHR$136:"       waiting........
"
   41REPEAT:X%=GET-47:UNTIL X%>0 AND X%<9:IF X%=8 GOTO48
   42 IF X%<>7 GOTO46  ELSE CLS:PRINT''CHR$131:"Enter the six amplitude paramete
rs in"'CHR$131:"the order:"''" 1) amp./step for attack (0-126)"'" 2) amp./step f
or decay (-126 to 126)"'" 3) amp./step for sustain (0 to -126)"
   43PRINT" 4) amp./step for release (0 to -126)"'" 5) target level for attack (
0-126)"'" 6) target level for decay (0-126)"'
   44FOR I%=1 TO6:REPEAT:PRINTTAB(0,10+I%*2);SPC38:TAB(0,10+I%*2):CHR$(128+I%);"
Enter parameter ";I%;CHR$(135-I%);:INPUTA%(I%)
   45UNTIL ((I%=5 ORI%=6)AND(A%(I%)>=0 AND A%(I%)<127) OR (I%=4 OR I%=3)AND(A%(I
%)<1 AND A%(I%)>-127) OR (I%=2 AND A%(I%)<127 AND A%(I%)>-127) OR (I%=1 AND A%(I
%)>0 AND A%(I%)<127)):NEXT:GOTO48
   46RESTORE47:FORI%=1 TO X%:FOR J%=1 TO 6:READA%(J%):NEXT:NEXT
   47DATA120,-1,-1,-2,120,119,120,-1,0,-126,120,119,2,2,0,-126,50,120,2,2,-1,-1,
50,120,2,2,0,0,50,120,20,20,0,0,60,120
   48CLS:PRINT'CHR$133:CHR$141:CHR$136:"  Pitch  selection......"'CHR$133:CHR$14
1:CHR$136:"  Pitch  selection......"'CHR$148:CHR$136:"   ":STRING$(16,CHR$96)'CH
R$134:"Select (by letter) one of these :"
   49PRINTCHR$130;" A) warble"'CHR$129;" B) plain"'CHR$132;" C) plain with fast,
heavy vibrato"'CHR$133:" D) plain with slow,heavy vibrato"'CHR$134;" E) plain wi
th medium vibrato"'CHR$131:" F) slide effect"'"  G) sci-fi (1)"
   50PRINTCHR$130:" H) sci-fi (2)"'CHR$129;" I) sci-fi (3)"'CHR$132;" J) sci-fi
(4)"'CHR$133;" K) define own pitch envelope"'CHR$134;" L) leave pitch envelope u
nchanged"
   51REPEAT:X%=GET-64:UNTIL X%>0 AND X%<13:IF X%=11 GOTO55 ELSE IF X%=12 GOTO60
   52RESTORE53:FORI%=1 TOX%:FOR J%=1 TO 8:READP%(J%):NEXT:NEXT
   53DATA1,1,1,-1,1,1,2,1,1,1,0,0,0,0,0,0,3,1,2,-2,2,1,2,1,6,1,2,-2,2,1,2,1,4,1,
1,-1,1,1,2,1,1,0,0,1,-1,20,15,15,1,1,48,48,48,2,2,2,3,1,48,48,48,2,3,4,1,1,48,48
,48,2,3,4,1,1,49,-47,51,10,10,10
   54GOTO60
   55CLS:PRINT''CHR$131:"Enter the seven pitch parameters in"'CHR$131;"the order
:"''" 1) length of a 'step' (1          '" 2) state of pitch repeat (0=off,1
=on)"'" 3) pitch/step for stage1 (-127 to 127)"
   56PRINT" 4) pitch/step for stage2 (-127 to 127)"'" 5) pitch/step for stage3 (
-127 to 127)"'" 6) no. of steps in stage1 (0 to 255)"'" 7) no. of steps in stage
2 (0 to 255)"'" 8) no. of steps in stage3 (0 to 255)"''
   57FOR I%=1 TO8:REPEAT:PRINTTAB(0,12+I%);SPC38:TAB(0,12+I%):CHR$(129+I%MOD7);"
Enter parameter ";I%;CHR$(135-I%MOD7);:INPUTP%(I%)
   58UNTIL (I%=1 AND P%(I%)>0 AND P%(I%)<128) OR (I%=2 AND (P%(I%)=0 OR P%(I%)=1
)) OR (I%>2 AND I%<6 AND ABS(P%(I%))<127) OR (I%>5 AND I%<9 AND P%(I%)>=0 AND P%
(I%)<256):NEXT
   59IF P%(2)=0 P%(1)=P%(1)+127
   60ENVELOPE1,P%(1),P%(3),P%(4),P%(5),P%(6),P%(7),P%(8),A%(1),A%(2),A%(3),A%(4)
,A%(5),A%(6):SOUND1,-10,100,4:PROCWAIT(100):GOTO19
   61DEFPROCWAIT(G%):TIME=0:REPEAT:UNTIL TIME=G%:ENDPROC
   62IF FNNORHYTHM GOTO19 ELSE:PRINTCHR$134;CHR$136;CHR$141;"      Alter timing
of tune...."'CHR$134;CHR$136;CHR$141;"      Alter timing of tune...."'CHR$146;CH
R$136;SPC7;STRING$(20,CHR$96)
   63PRINT''CHR$133:"You can alter the speed at which the"'CHR$133:"tune is play
ed back by altering the"'CHR$133:"time taken for it to be completely"'CHR$133:"p
layed back.This time interval is"'CHR$133:"given by you pressing RETURN twice"
   64PRINTCHR$133:"the time in between your two presses"'CHR$133:"being the new
length of the tune.So"'CHR$133:"the first press of RETURN corresponds"'CHR$133:"
to the first note in the tune and the"'CHR$133:"second press corresponds to the"
;
   65PRINT"last."'CHR$129:"SO PRESS RETURN TO START TIMING..":*FX15,0
   66REPEAT:UNTIL GET=13:TIME=0:PRINT'CHR$134;CHR$136:"NOW AWAITING SECOND RETUR
N":*FX15,0
   67 REPEAT:UNTIL GET=13:L%=TIME
   68 D=L%/(T%(N%)-T%(1))
   69FORI%=1 TON%:T%(I%)=INT(T%(I%)*D+.5):D%(I%)=INT(D%(I%)*D+.5):IF D%(I%)=0 D%
(I%)=1
   70IF D%(I%)>254 D%(I%)=255:NEXT:ELSE NEXT
   71 GOTO19
   72 DEF FNNORHYTHM:IF R%=-1 THEN  =0 ELSEPRINT"YOU HAVE NOT DONE THE RHYTHM":P
ROCWAIT(200):=-1
```

Program 1.

```
16775   3E 80      LD A, 80              CHR $ 128
        06 20      LD B, 20              Set up top row with 32 black squares
        D7         RST 10
        10 FD      DJNZ -3
        2A 0C 40   LD HL(D/F) 16396/7    Get start of D-File
        06 20      LD B, 20              Add 1 to D-F address
        23         INC HL
        36 17      LD(HL), 17            Print CHR$ 23
        36 80      LD(HL), 80            Erase it.
        10 F9      DJNZ -7               Move to next position and repeat until B = 0
        C9         RET                   Return to Basic.

10 RAND USR 16775.
```

Program 3.

```
16775   3E 1C      LD A, 1C              Print top row of characters 0 to 9, A to V.
        06 20      LD B, 20
        D7         RST 10
        3C         INC A
        10 FC      DJNZ -4
        2A 0C 40   LD HL(D/F)            Get start of D-File add 1 to point to 0,0;
        23         INC HL
        7E         LD A(HL)              Check for end of line character 118
        FE 76      CP 76
        C8         RETZ                  RET TO BASIC, end of line
        F5         PUSH AF               Store value
        36 80      LD(HL),80             Print square.
        11 00 10   LD DE 1000            Delay
        1B         DEC DE
        7A         LD A, D
        B3         OR E
        20 FB      JRNZ -5
        F1         POP AF                Retrieve value and print over black Chr.
        77         LD(HL),A
        18 EC      JR -20

10 RAND USR 16775
```

Program 4.

```
16775   3E 1C      LD A, 1C              Print top row 0 to V
        06 20      LD B, 20
        D7         RST 10
        3C         INC A
        10 FC      DJNZ -4
        0E 20      LD C, 20              Roll left 32 times
        2A 0C 40   LD HL(D/F)            Get start of D-F, move to position 0,0
        23         INC HL
        7E         LD A,(HL)             Get first CHR and store it
        F5         PUSH AF
        06 1F      LD B, 31
        23         INC HL                Get next character in line and put it into
                                         display file one place left
        7E         LD A,(HL)
        2B         DEC HL
        77         LD(HL) A
        23         INC HL                Move back to original position
        10 F9      DJNZ -7               Repeat 31 times
        F1         POP AF                Get stored CHR and put on end of line
        77         LD(HL) A
        11 00 10   LD DE 10 00           Delay Loop
        1B         DEC DE
        7A         LD A, D
        B3         OR E
        20 FB      JRNZ -5
        OD         DEC C                 Reduce C by 1 and if not zero then repeat
                                         Roll
        20 E4      JRNZ -28
        C9         RET                   Ret to Basic

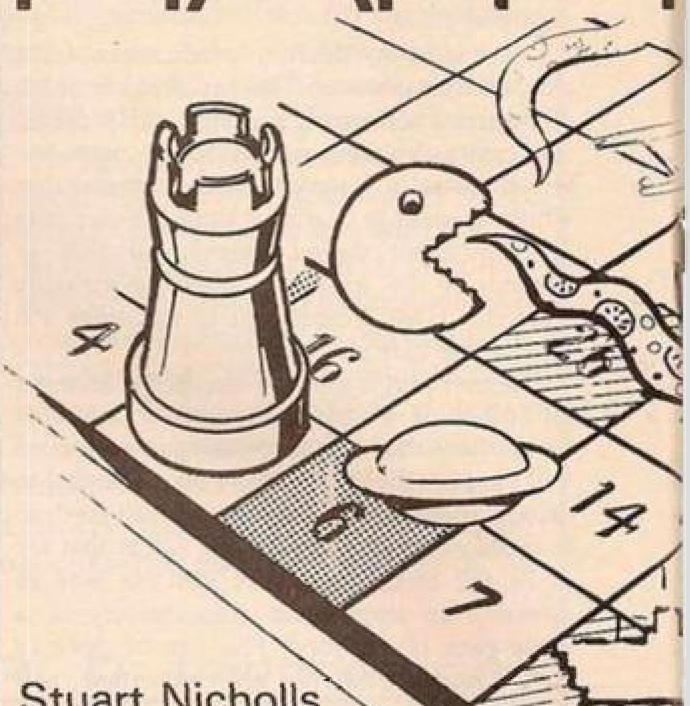
10 RAND USR 16775
```

Program 5.

```
16775   AF         X or A                AF loads A with 0 and resets carry flag in
                                         1 byte
        D7         RST 10                Print a space
        06 06      LD B, 06              Print six 9s
```

(listing continued opposite)

GAMES V
HAPPY



Stuart Nicholls puts some bounce into ZX-81 games as he shows how to make your Happy Hopper move.

LAST MONTH'S article left you with the Frogger display on the screen but how do you make it move?

First of all, the simple problem of moving a character one square at a time along the top row of the display: program 1 shows how this can be done.

If you have saved on tape the program from last month's issue then reload and use it to Poke the program into the line 2 REM statement. To run each of the demonstration programs change line 10 to

RAND USR 16775

and delete lines 20 to 90.

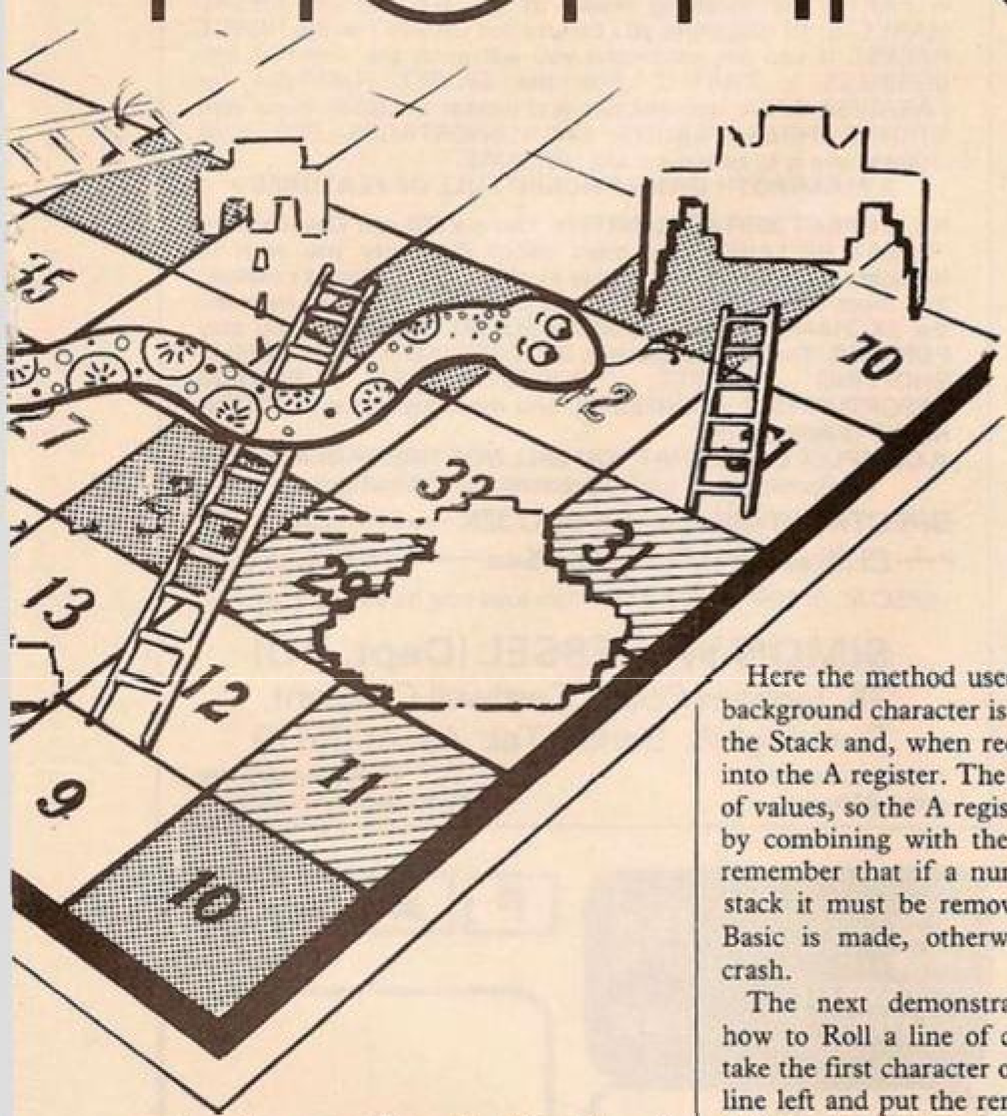
If you now Run program 1 you will realise how fast machine code really is. Did you see the asterisk move along the top row? You will now see that we need something to slow the computer down. The easiest way to do this is to tell it to count down from a high number to zero, which will take a second or two. This is similar to a For/Next loop in Basic. A high

Program 2.

To vary the speed of movement the value held in DE is changed.

```
16775   3E 80      LD A, 80
        06 20      LD B, 20
        D7         RST 10
        10 FD      DJNZ -3
        2A 0C 40   LD HL,(D/F)
        06 20      LD B,20
        23         INC HL
        36 17      LD(HL), 17
```

VRITING
/ HOPPING



number in a machine-code delay loop is around 4096/ 10 00 hex.

So program 1 can be rewritten as program 2 with the delay loop after print Chr$ 23 to hold the character on the screen for a second before erasing it and moving to the next position.

Now on to the problem of moving a character along a row with a background of differing characters and so overprinting the background, and then reprinting the original contents of each square as it moves. This is achieved by storing the contents of the background character before it is overprinted, and then retrieving the character and using it to erase the moving character, and is demonstrated in program 3.

		Delay loop
11 00 10	LD DE 10 00	counts
1B	DEC DE	4096 to 0
7A	LD A, D	before
B3	OR E	continuing
20 FB	JRNZ -5	with
		program
36 80	LD(HL),80	
10 F1	DJNZ -15	
C9	RET	

10 RAND USR 16775

Here the method used to store the original background character is to Push its value onto the Stack and, when required, to Pop it back into the A register. The stack only stores pairs of values, so the A register is made into a pair by combining with the flags register F. But remember that if a number is stored on the stack it must be removed before a return to Basic is made, otherwise the program will crash.

The next demonstration program shows how to Roll a line of characters left, that is, take the first character of the screen, move the line left and put the removed character at the right-hand end of the line.

And finally a program to demonstrate how to count on the screen — this is a useful routine for keeping scores or giving a time limit for a game. This is shown in program 5, where we ask the computer to count down — without delay loop — from 999999 to 0, again demonstrating the speed of machine language. The program takes 2.25 minutes.

Incidentally I find it good programming practice to use each of the registers for one purpose as much as possible. I use the HL register pair for screen address — D-File — and the DE register pair for adding to and subtracting from HL, to move the screen address up or down 1 row.

I use the B register for counting, For/Next loops and the C register for checking if subroutines are necessary, by either holding value of 0 or 1. The A register is used for holding contents of display file position and comparing the contents.

In this way it is easier to keep track of the contents of each register and to know which registers are free to use again later in the program.

We now move on to finish the Frogger program. Reload the program so far and check that line 10 reads

LET X = 16775

Change to Fast mode and enter the remaining codes as listed. After the last byte 41 at address 17027 is listed then enter S to Stop the Basic program. Change to Slow mode; change line 10 to read Rand USR 16701 and line 20 to read 20 Print "space End"; delete lines 30 to 90 and Save the program.

Line 20 was put in as an afterthought but could easily be added in machine code. I found after writing the program that there was sufficient memory left in 1K to add this line.

If you have 2K or 3K of memory available then more Basic can be added giving instructions on how to play the game and maybe even a best score/time facility.

All that is needed now is to enter Run and off you go. Happy hopping. ■

(Program 5 continued)

3E 25	LD A, 25	
D7	RST 10	
10 FD	DJNZ -3	
2A 0C 40	LD HL D F	Get start of D-File and add 7 to find position of last 9
11 07 00	LD DE 00 07	
19	ADD HL, DE	
7E	LD A,(HL)	
A7	AND A	Check to see if D-File position is a space. If it is, then end of count-down, so print six 0s and RET
20 08	JRNZ +8	
06 06	LD B, 06	
23	INC HL	
36 1C	LD(HL), 1C	
10 FB	DJNZ -5	
C9	RET	
3D	DEC A	If not a space then decrease number and check for .
FE 1B	CP 1B	
20 05	JRNZ +5	
36 25	LD(HL),25	If . then print a 9 and move to next D-F position
2B	DEC HL	
18 EA	JR -22	
77	LD(HL),A	If not . then print new number
18 E0	JR -32	Repeat until zero

10 RAND USR 16775

BASIC DICTIONARY

This dictionary, compiled by Tony Edwards, will explain the function of common Basic words as used in popular machines, enabling you to work out your own machine's equivalent. A useful complement to our recent series on Basic dialect translation.

ENDPROC A BBC statement denoting the end of a procedure, see PROC. It causes all local variables to be restored and returns control to the line after the calling statement.

ENVELOPE A BBC Basic statement from the extended set. It has 14 parameters which are used as individual machine-code bytes by the operating system to control the sound generator.

EOF A function to test for the end of a file. The argument is the file channel-number and the function returns logical true, –, if the file has ended, otherwise 0.

EOR A logical operator producing the bitwise integer logical exclusive OR between two 32-bit integers. It appears in BBC Basic's extensions.

EQ An equivalent of the = sign.

ERL A function which returns the line number in which an error occurs once it has occurred. It retains the line number value until the next error occurs. Its normal use is during debugging.

ERR A Microsoft Basic function which returns the Error code of the last error which occurred. Its normal use is in debugging.

ERROR This word can be used as a statement or a command. It has the effect of simulating an error. The specific type of error simulated is controlled by the argument following the statement. It is usually used during debugging to check error-trapping routines, but can also be used within a program to print out uncalled-for error messages.

EVAL This is a statement which applies the interpreter's expression-evaluation routine to the characters held in the string indicated by the argument. Its use is to allow a program user to input a function into a program by simply inputting a suitable string.

EXAM The function used by some computers to read the contents of a memory location specified by the argument. It is the equivalent of PEEK.

EXP A function returning e to the power of the argument. It is the inverse of the LOG function.

EXT A function returning the length, in bytes, of a file whose channel number is the argument.

F

F. An abbreviation for FOR used by Microsoft Level 1, and Palo Alto Tiny Basic.

FALSE A BBC function which returns the logical false that is, 0.

FETCH A function used by some computers to read the contents of a memory location specified by the argument. It is the equivalent of PEEK.

FILL A function which places its second argument in the memory location identified by its first argument. It is equivalent to PEEK.

FIX A function which removes the decimal part of a variable's value. With positive numbers this rounding down is identical to the INT function. However, with negative numbers it rounds them up by making them less negative.

FLASH A statement used in Apple-II Basic to cause the VDU display to flash.

FN The reserved letters to be placed at the start of a function name. It must first be defined following a DEF statement. Then it can be invoked as can any of the machine's built-in functions.

FOR The initialising statement of a For . . . To (NEXT) statement which is used universally to assign a range of numbers between two specified values to the specified variable. The loop is terminated by the NEXT statement. An ANSI standard word.

FRE A function which returns the number of bytes of unused string space available within the computer's reserved memory stack. The argument is a dummy with no significance. The same word is used on some other computers to return the total amount of unused memory available.

FREE(0) A function used to report the total amount of file memory available. Equivalent to the MEM function.

G

G. An abbreviation for GOTO used by Microsoft Level 1 Basic.

GCOL A statement used in BBC Basic to set the graphics foreground and background colours.

GE The TI-99 equivalent of the "greater than or equal to" sign.

GET A function which inputs a key input without requiring a Newline or Enter. On some machines execution will stop, awaiting a key depression, for example Apple, but on others the execution continues, unless a key is pressed.

GET# A function used in Pet and Atari Basic to read a character from a data tape.

GOS. Used as an abbreviation of GOSUB on Atom, and Microsoft Level 1 machines.

GOSUB The ANSI standard statement to cause a branch to a subroutine.

GOT A PDP-8E abbreviation of GOTO.

GOTO The ANSI standard statement to cause a jump to another part of the program. Also used in the form GO TO.

GOTO . . . OF A multiple-branching GOTO. The control will be passed to the line number following the OF which is in the numerical position of the argument, that is:

```
GOTO X OF 10,20,30
```

will branch to 10, 20 or 30 if X has the values of 1, 2 or 3. Some computers expect a space between GO and TO.

GR A function or statement in Apple II Basic which switches the screen display between different modes.

GT The equivalent of a "greater than" sign.

H

HCOLOR An Apple II command which, following HGR, identifies which colour is to be used.

HGR The Apple II command which sets the screen for hi-resolution graphics mode.

HIMEM A pseudo-variable which holds the address of the highest-numbered memory location available for use by the interpreter. Higher numbered addresses are effectively non-existent, as far as Basic is concerned, but can be filled with data or machine code which can be jumped to from Basic. Similar to MEM SIZE? and READY?

HLIN . . . AT An Apple II graphics command which draws a horizontal line from the first argument to the second, at the vertical position indicated by the third argument.

HOME A command which clears the screen and returns the cursor to the upper left corner of the screen. Identical to CLS.

HPLOT This command sets a high-resolution graphic block on the Apple II.

HTAB The command in the Apple II set which moves the next print position horizontally. Identical to TAB.

I

I Used in TRS-80 Level 1 and Palo Alto Tiny Basic as an abbreviation for INT.

IF Part of a multiple branching statement. For details of full statements see below. An ANSI standard statement.

IF. . .G Used in TRS-80 Level 1 and Palo Alto Tiny Basic as an abbreviation for IF . . .GOTO.

IF. . .GOS Used in TRS-80 Level 1 and Palo Alto Tiny Basic as an abbreviation for IF. . .GOSUB. ■

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FORTH DIMEN

This is a Forth simulation by R C Ranson for the ZX-81 enabling you to try out this structured language.

ESSENTIALLY, FORTH is a high-level language which retains much of the flexibility associated with assembly language. Program development time is short because of its interactive, modular construction and very simple program test arrangements.

In execution, Forth is fast because individual program elements are semi-compiled on entry and then linked together by a very fast address interpreter routine. However, unlike other compiled languages, for example Pascal, a Forth system is very compact — a complete Z-80-based system with compiler and dictionary could reside in 8K of ROM.

This article describes a ZX-81 Basic program designed to simulate some features of Forth so that you can try it out on a terminal. It illustrates the unconventional Forth syntax and the principle involved in the semi-compiled code operation. But do not mistake this for the real thing. Because it operates in Basic it is relatively slow and does not have the same flexibility as a dedicated Forth implementation.

Forth is a structured language in which the elementary programming units are words separated by spaces. Each word is defined in the system in a list — called the dictionary — by combining the operation of previously-defined words. Programs are developed in a top-down fashion writing words to do individual tasks, then words which combine these tasks and so on until the whole program is just one word.

At each stage the interactive nature of Forth allows words to be tested and debugged.

During execution the Forth system calls each address in turn, thus performing the desired task in terms of previous tasks. In principle there is no limit to the depth of this task subdivision process. The Forth system keeps track of each level of nested words by means of a return address stack just like calling subroutines within subroutines in Basic. Thus, words are defined in terms of other words within the dictionary, until words are encountered which actually perform machine-coded instructions. These lowest-level words are called primitives and a typical Forth system containing 400 words could have as few as 50 primitives.

All this nesting and stack work is performed by the address interpreter which in Z-80 code is only 20 bytes long and so very fast in operation.

The other main feature of Forth is the parameter stack which is used for data communication between words. For example, Forth words do not have formal parameter lists; each word operates on stack data, so the syntax follows reverse-polish notation popularised by Hewlett-Packard calculators. There is what is also known as postfix notation, for example 2+2 becomes 2 2 + where the spaces are significant as they define the end of each entry. In this example the word + takes two items off the stack.

The stack orientation is very flexible and means that very few named variables are defined; values are merely Pushed on to the stack by one word and Popped off by the next. It is however essential to keep track of the stack entries in order to ensure that the right values are passed on. In practice all this stack use is highly efficient in machine terms and also easy to use as Forth includes many powerful stack operators.

In the simulation program the Basic text is equivalent to the machine-code system, including primitives, and the line numbers are equivalent to addresses.

It contains three distinct blocks of code which roughly correspond to features in a real Forth system. Lines 10 to 450 contain the text interpreter which scans the input string I$, picks out individual words and executes them in sequence.

```
0010 REM ************************
0020 REM *FORTH SIMULATION IN*
0030 REM *ZX81 BASIC. R.RANSON*
0040 REM ************************
0050 PRINT "BASIC FORTH V.2"
0060 DIM P(10)
0070 DIM Q(10)
0080 DIM R(10)
0090 DIM S(10)
0100 LET Z=300
0110 REM INITIAISE
0120 PRINT
0130 GOTO 200
0140 PRINT A$;"?"
0150 GOTO 200
0160 PRINT "OK"
0170 GOTO 220
0180 PRINT "STACK EMPTY AT ";A$
0190 LET S(1)=0
0200 LET M=1
0210 LET N=1
0220 LET K=1
0230 LET I$=""
0240 REM
0250 INPUT I$
0260 LET L=0
0270 LET Q(K)=L
0280 LET P(K)=LEN I$
0290 LET L=P(K)
0300 IF N<1 THEN GOTO 180
0310 LET Q(K)=Q(K)+1
0320 IF Q(K)>P(K) THEN GOTO 410
0330 LET B$=I$(Q(K) TO Q(K))
0340 IF B$=" " THEN GOTO 310
0350 LET A$=B$
0360 LET Q(K)=Q(K)+1
0365 IF Q(K)>P(K) THEN GOTO 460
0370 LET B$=I$(Q(K) TO Q(K))
0380 IF B$=" " THEN GOTO 460
0390 LET A$=A$+B$
0400 GOTO 360
0410 IF K<2 THEN GOTO 160
0420 LET K=K-1
0430 LET I$=I$( TO P(K))
0440 LET L=P(K)
0450 GOTO 310
0460 PRINT "█";A$;
0470 REM USER DEFINED DICTIONARY
0500 IF A$<>"ABS" THEN GOTO 600
0530 LET I$=I$+" DUP 0 < IF -1 *
 THEN"
0540 LET K=K+1
0550 GOTO 270
0600 IF A$<>"COUNT" THEN GOTO 700
0630 LET I$=I$+" 0 DO CR I . LOOP"
0640 LET K=K+1
0650 GOTO 270
0700 IF A$<>"POLY1" THEN GOTO 800
0730 LET I$=I$+" DUP DUP * + 1 -"
0740 LET K=K+1
0750 GOTO 270
0800 IF A$<>"POLY2" THEN GOTO 900
0810 GOSUB 830
0820 GOTO Z
0830 GOSUB 2030
0840 GOSUB 2030
0850 GOSUB 3230
0860 GOSUB 3030
0870 LET A$="1"
0880 GOSUB 9040
0890 GOSUB 3030
0895 RETURN
1000 REM SYSTEM DICTIONARY
1100 IF A$<>"." THEN GOTO 1200
1110 GOSUB 1130
1120 GOTO Z
1130 PRINT S(N);" ";
1140 LET N=N-1
1150 RETURN
1200 IF A$<>"S?" THEN GOTO 1300
1210 GOSUB 1230
1220 GOTO Z
1230 FOR Y=0 TO N-2
1240 PRINT S(N-Y)
1250 NEXT Y
1260 RETURN
1300 IF A$<>"EMIT" THEN GOTO 1400
1310 GOSUB 1330
1320 GOTO Z
1330 PRINT CHR$ S(N);
1340 LET N=N-1
1350 RETURN
1400 IF A$<>"SPACE" THEN GOTO 1500
1410 GOSUB 1430
1420 GOTO Z
1440 PRINT " ";
1450 RETURN
1500 IF A$<>"CR" THEN GOTO 1600
1510 GOSUB 1530
1520 GOTO Z
1530 PRINT
1540 RETURN
1999 REM STACK INSTRUCTIONS
2000 IF A$<>"DUP" THEN GOTO 2100
2010 GOSUB 2030
2020 GOTO Z
2030 LET N=N+1
2040 LET S(N)=S(N-1)
2050 RETURN
2100 IF A$<>"DROP" THEN GOTO 2200
2110 GOSUB 2130
2120 GOTO Z
2130 LET N=N-1
2140 RETURN
2200 IF A$<>"SWAP" THEN GOTO 2300
2210 GOSUB 2230
2220 GOTO Z
2230 LET S(N+1)=S(N-1)
2240 LET S(N-1)=S(N)
2250 LET S(N)=S(N+1)
2260 RETURN
2300 IF A$<>"OVER" THEN GOTO 2400
2310 GOSUB 2330
2320 GOTO Z
2330 LET N=N+1
2340 LET S(N)=S(N-2)
2350 RETURN
2400 IF A$<>"I" THEN GOTO 2500
2410 GOSUB 2430
2420 GOTO Z
2430 LET N=N+1
2440 LET S(N)=R(M)
2450 RETURN
2999 REM ARITHMETIC AND LOGIC
3000 IF A$<>"+" THEN GOTO 3100
3010 GOSUB 3030
3020 GOTO Z
3030 LET N=N-1
3040 LET S(N)=S(N)+S(N+1)
3050 RETURN
3100 IF A$<>"-" THEN GOTO 3200
3110 GOSUB 3130
3120 GOTO Z
3130 LET N=N-1
3140 LET S(N)=S(N)-S(N+1)
3150 RETURN
3200 IF A$<>"*" THEN GOTO 3300
3210 GOSUB 3230
3220 GOTO Z
3230 LET N=N-1
3240 LET S(N)=S(N)*S(N+1)
3250 RETURN
3300 IF A$<>"/" THEN GOTO 3400
3310 GOSUB 3330
3320 GOTO Z
3330 LET N=N-1
3340 LET S(N)=S(N)/S(N+1)
3350 RETURN
3400 IF A$<>"=" THEN GOTO 3500
3410 GOSUB 3430
3420 GOTO Z
3430 LET N=N-1
3440 LET S(N)=S(N)=S(N+1)
3450 RETURN
3500 IF A$<>"<" THEN GOTO 3600
3510 GOSUB 3530
3520 GOTO Z
3530 LET N=N-1
3540 LET S(N)=S(N)<S(N+1)
3550 RETURN
3600 IF A$<>">" THEN GOTO 3700
3610 GOSUB 3630
3620 GOTO Z
3630 LET N=N-1
3640 LET S(N)=S(N)>S(N+1)
3650 RETURN
3999 REM CONTROL INSTRUCTIONS
4000 IF A$<>"IF" THEN GOTO 4200
4030 LET N=N-1
4040 IF S(N+1) THEN GOTO Z
4050 FOR Y=Q(K) TO P(K)-3
4060 LET B$=I$(Y TO Y+3)
4070 IF B$="ELSE" THEN GOTO 4120
4080 IF B$="THEN" THEN GOTO 4120
4090 NEXT Y
4100 PRINT "ERROR IN IF"
4110 GOTO 200
4120 LET Q(K)=Y+4
4130 GOTO Z
4200 IF A$<>"ELSE" THEN GOTO 4300
4210 GOTO 4050
4300 IF A$<>"THEN" THEN GOTO 4400
4310 GOTO Z
4400 IF A$<>"DO" THEN GOTO 4500
4410 LET M=M+2
4420 LET R(M-1)=Q(K)
4430 LET R(M)=S(N-1)
4440 LET M=M+1
4450 LET R(M)=S(N)
4460 LET N=N-2
4470 GOTO Z
4500 IF A$<>"LOOP" THEN GOTO 4600
4510 LET R(M)=R(M)+1
4520 IF R(M-1)>R(M) THEN GOTO 4550
4530 LET M=M-3
4540 GOTO Z
4550 LET Q(K)=R(M-2)
4560 GOTO Z
8900 IF A$<>" STOP " THEN GOTO 900
0
8910 STOP
8999 REM CONVERT TO A NUMBER
9000 LET Y=CODE A$
9010 IF Y<>22 AND (Y<27 OR Y>37)
 THEN GOTO 140
9020 GOSUB 9040
9030 GOTO Z
9040 LET N=N+1
9050 LET S(N)=VAL A$
9060 RETURN
9999 GOTO 300
```

Listing 1.

SIONS

Execution is performed by searching through the dictionary to find the word and then calling that word as a subroutine — lines 1000-9000. Space has been left at the top of the dictionary for the definition of new words — lines 460-999. There are two stacks defined by the arrays R and S with corresponding stack pointers M and N. These are the Return and Data stacks respectively.

Note that the Basic system subroutine stack is used for nesting words and this dual-return stack arrangement does lead to limitations in the compile mode of operation. It is also the reason for the rather clumsy-looking construction of Gosub followed by Goto instructions in the dictionary.

Using the program in listing 1, first check the operation of the text interpreter. Run and imput 33 2 to the prompt and then press return. The system responds with ■33■2 OK. This shows that the two words 33 and 2 have been picked out individually by the interpreter and executed correctly by the program; the inverse space shows the gap between words and OK means that the current instruction was understood.

To stop use the stop, entry key then return with other words — note that any extra spaces are ignored. If you are happy with the text interpreter operation, delete line 460. Continuing the example above, what happens is that each number is entered on to the stack; to confirm this use the word S? and the whole stack should be displayed.

All words are first looked up in the dictionary and if not found are converted to numbers using the Val function, lines 9000-9060. The dictionary consists of a user-defined part and the system part. The system words are all primitives — they are tabulated in table 1 for easy reference.

You can try words out just by typing them in but remember to include the necessary number of stack entries before each word. With 33 and 2 on the stack, type +, this adds the two entries and leaves the sum on the stack. The word . prints the top stack entry and deletes it and this gives the answer 350K.

Some words need no stack entries, for example Dup pushes the top stack value on to the stack creating an extra entry. The combination Dup will thus print the top of stack without destroying it. Alternatively if you cannot follow what is going on remember S? before and after each word shows all the stack operations.

The ability to create new words in the dictionary is the single most powerful tool in Forth. A full implementation has words specially designed to help do this but this simulation does not. However, it is possible to create new words by adding not only the definition but also a few lines of Basic to scan the dictionary, call the routine and pass control back to the text interpreter.

For example, lines 700-750 listing 1 add the word Poly1 to the dictionary. This evaluates the polynomial X^2+x+1 using x as the top

Line	Word	Stack	Comment
			Printing Instructions
1130	.	n - -	Print and Delete top stack entry
1230	S?	- - -	Print all of stack
1330	Emit	n - -	Print top of stack as a character
1430	Space	- - -	Print a space
1530	CR	- - -	Print a Newline
			Stack instruction
2030	Dup	n, - n,n,	Duplicate top of stack entry
2130	Drop	n - -	Discard top of stack entry
2230	Swap	n,n_2 - n_2n,	Exchange top two stack entries
2330	Over	n,n_2 - n,n_2n,	Duplicate second stack entry on the top
2430	I	- - n	Copy top of return stack on to data
			Arithmetic and logic
3030	+	n,n_2 - n, + n_2	Use top two stack entries
3130	-		Deletes them and puts
3230	*		arithmetic result into the
3330	/		top stack entry.
3430	=		Uses top two stack entries
3530	<		deletes them and puts 1050
3630	>		on to stack for true or false.
			Control instructions
4030	If	n	If n is true continue execution
4200	Else		Otherwise skip to Else or Then
4300	Then		Continue execution
4400	Do	n, n	Save Instruction pointer loop limit n, and count n_2 on return stack
4500	Loop		Increment loop-count branch back if less than limit . . . Otherwise delete three return stack entries and continue.

Table 1.

stack entry and leaving the result on the stack. It could be done directly by typing:

3 DUP DUP * + 1 + .

The answer is 13 OK. Alternatively type

3 POLY 1 .

and the answer is the same. To see this in operation, add line 460 and repeat the above.

When Poly1 is executed, it appends the Dup Dup instructions to I$. These are then executed by the text interpreter just as if they had been typed in the first place. Other words can be added in the same way and note that new words can use other new words. The examples in listing 2 show the word star used by the new words Star2 and StarS.

The control words are best explained by example. The word ABS line 500 listing 1 illustrates the use of the If construction. A zero on the stack — that is, false — makes execution continue after the Else, otherwise it continues after If and skips from Else to Then. Else may be omitted and then no operation occurs for the false case. Examples are given in listing 3.

The word Count line 600 — listing 1 — illustrates the Do Loop configuration. Do marks the beginning of a loop and removes two stack entries, equivalent to the For and To values in Basic.

The Loop word is equivalent to Next but always increments the loop count by 1. The

Listing 2.

```
BASIC FORTH V.2
■STAR■23■EMIT*OK
■STAR2■STAR■23■EMIT*■STAR■23■EMI
T*OK
■3■STARS■0■DO■STAR■23■EMIT*■LOOP
■STAR■23■EMIT*■LOOP■STAR■23■EMIT
*■LOOPOK
■ STOP
 460■PRINT "■";A$;
 470 REM USER DEFINED DICTIONARY
 500 IF A$<>"STAR" THEN GOTO 600
 530 LET I$=I$+" 23 EMIT"
 540 LET K=K+1
 550 GOTO 270
 600 IF A$<>"STAR2" THEN GOTO 70
0
 630 LET I$=I$+" STAR STAR"
 640 LET K=K+1
 650 GOTO 270
 700 IF A$<>"STARS" THEN GOTO 80
0
 730 LET I$=I$+" 0 DO STAR LOOP"
 740 LET K=K+1
 750 GOTO 270
 800 IF A$<>"POLY2" THEN GOTO 90
0
 810 GOSUB 830
 820 GOTO Z
 830 GOSUB 2030
 840 GOSUB 2030
 850 GOSUB 3230
 860 GOSUB 3030
 870 LET A$="1"
 880 GOSUB 9040
 890 GOSUB 3030
 895 RETURN
1000 REM SYSTEM DICTIONARY
1100 IF A$<>"." THEN GOTO 1200
1110 GOSUB 1130
1120 GOTO Z
```

Listing 3.

```
BASIC FORTH V.2
■-3■ABS■DUP■0■<■IF■-1■*■THEN■.3
OK
■3■ABS■DUP■0■<■IF■.3 OK
■5■0■=■IF■5■.5 ■THEN■6■.6 OK
■0■0■=■IF■4■.4 ■ELSE■6■.6 OK
■ STOP
```

Listing 4.

```
BASIC FORTH V.2
■3■POLY1■DUP■DUP
■*■+■1■+■.13 OK
■3■POLY2■.13 OK
■ STOP
```

Listing 5.

```
BASIC FORTH V.2
■5■COUNT■0■DO■CR
I■.0 ■LOOP■CR
I■.1 ■LOOP■CR
I■.2 ■LOOP■CR
I■.3 ■LOOP■CR
I■.4 ■LOOPOK
■ STOP
```

code between Do and Loop should not add or delete data stack entries and must not add or delete return stack entries. This is because you can loose control of the data stack and because the loop counts are held temporarily on the return stack. Hence the use of I to put the loop count on to the data stack. The example 5 Count is shown in listing 4.

Finally, in the Poly1 example, the printout from line 460 shows each word and the insertions being executed by the text interpreter. A great deal of time is spent matching strings and searching through the dictionary for words that are already defined. This is of course quite unnecessary and is included here for illustrative purposes only.

When a new word is defined all the words within it are in the dictionary and fixed, all that is necessary is to call each word in turn using its line number — address — and this saves the extra slog of dictionary searches. This compilation is done automatically by a proper Forth system, but in the simulation it must be done by hand.

The alternative Poly1 definition Poly2 illustrates a compiled word as it would appear in Forth. The construction is very similar to a primitive, except that the word definition — lines 830-895 — contains Gosub calls to line numbers. The line numbers are the address of the words in the Poly1 definition, see table 1. Line 870 inserts the number 1 string into A$ for conversion by the number routine.

If you now repeat the Poly1 examples, with line 460 again, you can see the instruction executed immediately and rather quicker.

In Forth most words are made up in this fashion with lists of addresses rather than the machine code and this is the reason for its compactness and its portability since only the system code and primitives are machine dependent. ■

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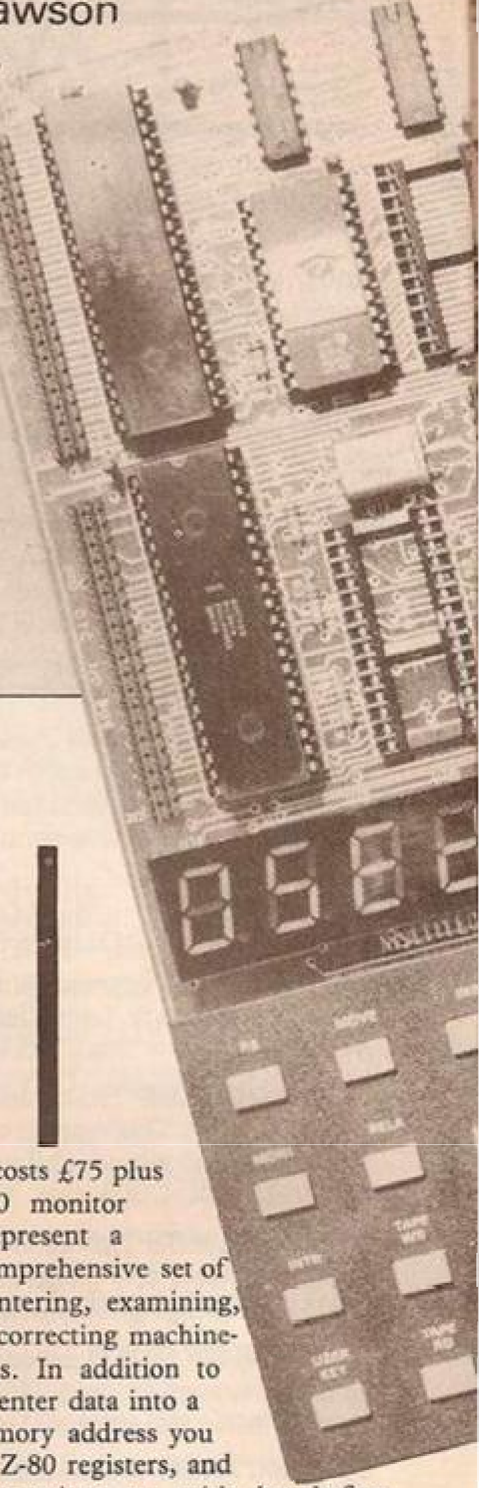
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Before I received the Micro-Professor for review I had read only one previous article in which the author moaned continually about the inappropriateness of teaching computing at machine-code level. He said that what the younger generation needed was a broad appreciation of computing based, where necessary, on the use of high-level languages and that machine code was irrelevant except to a very few systems engineers.

This black-box approach to computers and their application is adequate — so far as it goes. If the machine you use runs much faster than you need and if you have the resources to purchase all the modules that you need, and if you never need to stretch the high-level language you use, then all will be well. If, on the other hand, you want to explore, and if you want to use a computer for a new purpose, something beyond other people's experience, then you must understand more about how the black box is constructed and how it functions. You may not use machine code in your new application, but you are more likely to be successful if you understand something of the highways and byways of microprocessors.

The construction of a program in machine code is strictly comparable to using an ordinary Microsoft Basic. Both languages have facilities for taking information into the computer, processing data using conditional jumps, calls to subroutines, comparison and mathematical operators, and displaying the results in a form that is intelligible to the user.

The Micro-Professor computer is 6.2in. wide, 8.8in. deep from front to back, and just under 0.75in. thick. A 2.25in. loudspeaker is mounted on the board with the diaphragm at the rear. There are 36 hard plastic keys on the keyboard and the keys travel about 2mm. when they are depressed. The keyboard appears to be well-made and is pleasant to use with adequate inter-key spacing.

Information display

Information is displayed on six 0.5in. seven-segment Light Emitting Diode — LED — displays and the character set that can be achieved using seven segments is shown in figure 1. At the rear, right side of the board are two 3.5mm. jack sockets for connection to a cassette-tape recorder and a power-input socket.

A 7805 IC regulator is fitted on a heatsink and the manual says that the input voltage may be between 7 and 24V. A 230V mains power supply unit — PSU — is provided with generous leads about 6ft. long, and this provides 9V DC at about 500 mA.

The PSU was supplied with a 13A plug already connected. The PSU became cool-to-warm when the machine ran for several hours in the course of the review while the 7805 regulator heatsink became too hot to touch. The manual states that this will happen and explains that it is not a matter for concern.

In front of the power regulator is a breadboard area that may be used to hand-wire your own circuits. There is room for approximately eight 16-pin ICs or a mixture of the wider 24-pin packages with some 14- or 16-pin ICs and discrete components. 5V and ground rails are distributed throughout the breadboard area with convenient holes for a smoothing capacitor.

The Z-80 Central Processor Unit — CPU — is located at the rear left side of the Micro-Professor board and there are three 24-pin sockets for the Erasable Programmable Read Only Memory — EPROM — containing the fundamental operating program — the monitor, the RAM supplied with the machine, and one socket that may be used for either additional RAM or another EPROM.

Like the Apple computer, a number of jumper connections are available on the board. These must be either cut, or connected to alter the configuration to suit each of the various chips that may be plugged into the spare socket.

Unlike many other cheap — and not so cheap — computers, there is no need to fiddle about trying to connect wires to odd pins of other components — the options on the Micro-Professor board have been well thought out.

An 8255 Programmable Peripheral Interface — PPI — chip is used to drive the LED display and the keyboard. Two sockets are provided for a Parallel Input/Output — PI/O — chip and a Counter Timer Circuit — CTC — IC. Finally, and very important they are too, there are two standard, properly-designed, sockets on the extreme left of the board that carry all the connections to the Z-80 CPU and the signal lines from the PI/O and CTC chips.

The connections to the Z-80 form a bus that will, in theory, allow you to expand the Micro-Professor computer to a full 64K, twin floppy-disc, business-orientated system.

If you want to expand the computer, however, you will have to increase the drive capacity of the Z-80 bus. The data and address lines are not buffered on the main board. System buffering is carried out on the EPROM programmer board.

The printed-circuit board is well made with gold-plated connections, a green solder-resist on both sides and the component locations, and values silk-screened on to the top surface.

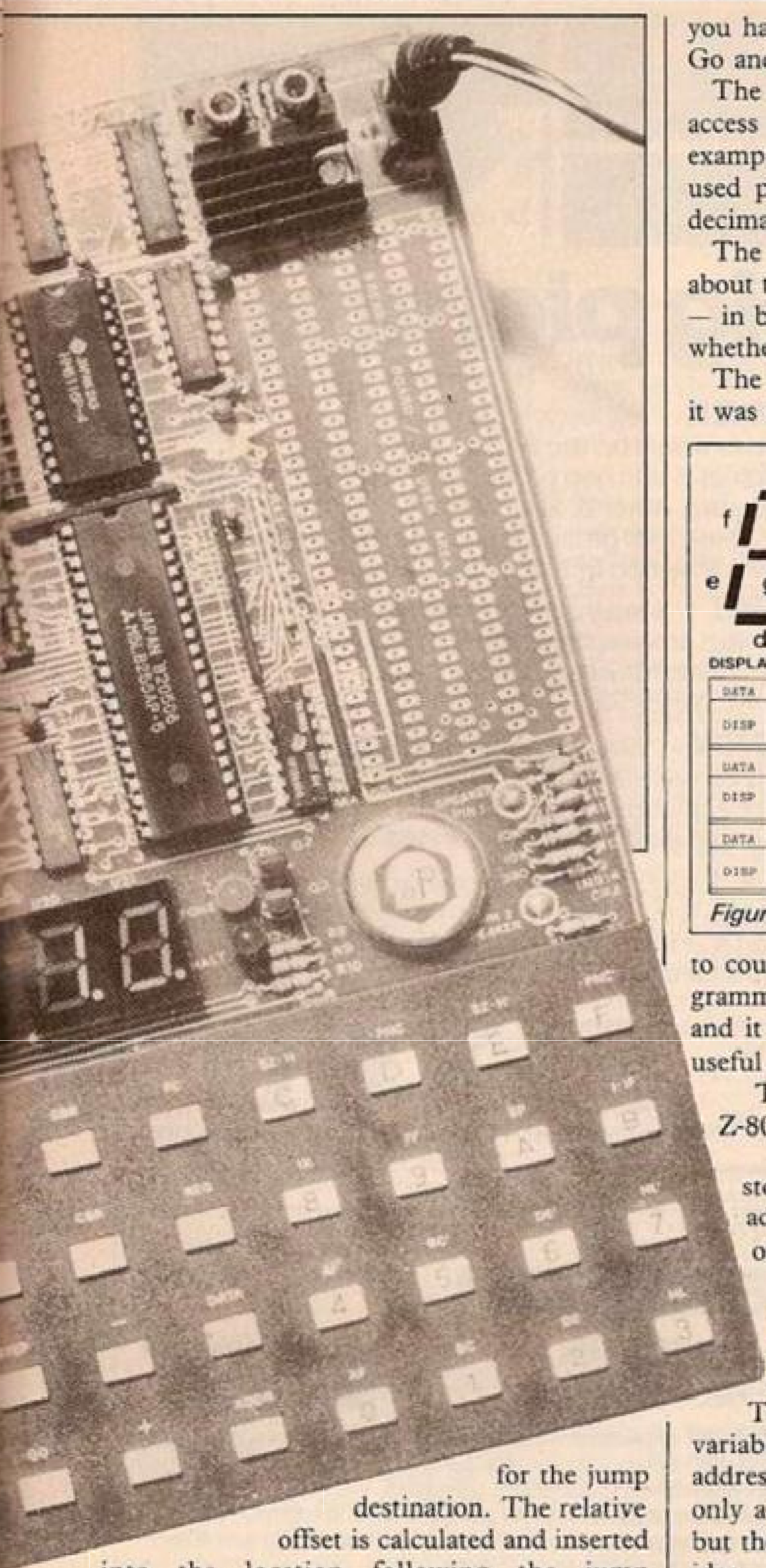
Two versions of the Micro-Professor computer have been marketed in this country. The original computer — MPF-1 — had a 2K monitor only and this was extended in the MPF-1B to include a 2K Tiny Basic. The MPF-1B is now the only version that is available and this costs £75 plus VAT. The 20 monitor commands represent a reasonably comprehensive set of facilities for entering, examining, running and correcting machine-code programs. In addition to the ability to enter data into a particular memory address you may load the Z-80 registers, and the alternative register set, with data before starting to run a program.

The SBR and CBR commands Set and Clear a single break-point to allow you to stop a program at a specified address to examine the status of the Z-80 CPU. The Move command is intelligent in the sense that the monitor calculates for itself in which direction data should be moved to avoid corrupting the memory. Other monitors of my acquaintance are not so smart.

Relative jumps

The Delete and Insert commands will move the data in the memory down or up one byte. The delete command removes the data at the address for which the command was entered and the Insert command enters a no-operation instruction — 00 Hex — at the address from which the instruction was entered.

Relative jumps can be calculated using the Rela command. The monitor assumes that the current address is the start of the jump, unless you enter a different number, and then asks



for the jump destination. The relative offset is calculated and inserted into the location following the jump instruction. If the jump is outside the range that the Z-80 can handle an error message is displayed. There is no consistent way of recovering from errors except to reset the computer; this is acceptable in the Micro-Professor as the Reset key does not destroy existing programs or data.

The tape Read and Write commands are easy to use and the method of setting the start and end addresses for the block you wish to save is consistent with other block commands in the monitor.

The level control for the tape recorder is excellent; there is either sufficient signal from the tape recorder or not enough. When the output level from the tape recorder is high enough, a Schmitt trigger in the computer operates and the input signal can be heard on the loudspeaker. When the volume is low, the trigger does not operate and there is no sound and no input to the computer memory.

Programs that you save on tape may have file names consisting of a number between 0 and 255, and the monitor will search through a tape until it finds the correct program. When you have loaded a tape file you simply press Go and the computer executes the program.

The monitor is easy to use and allows good access to the Z-80 flags and registers. For example, most of the other computers I have used print the CPU flag register as a hexadecimal value — E5 would be typical.

The Micro-Professor presents information about the flags in exactly the form you want it — in binary — 01100010, so that you can tell whether a flag is Set or Reset.

The Basic is pretty basic. I understand that it was added to the monitor EPROM in order to counter criticism about machine-code programming for young people. Well, it does that and it has two instructions that make it very useful for controlling the PIO and CTC chips.

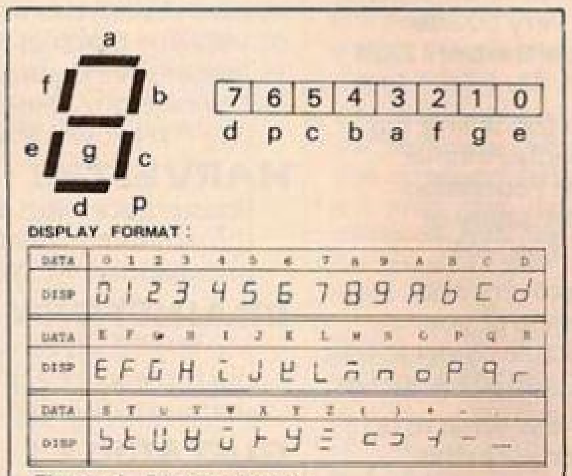


Figure 1. Display format.

Two variables are reserved to access the Z-80 ports and RAM locations:

LET M 3477 = 750

stores the value 750 at the decimal address 3477. The instruction works the other way in this form:

LET A3 = M 3991

which will get the value stored at RAM location 3991 decimal and store it in variable A3.

There are similar instructions for the P variable which relate to the Z-80 port addresses. The Micro-Professor instruction is only a convenient Deek and Doke alternative but the P instruction is an original and useful idea.

When you are programming in Basic the machine takes a single keystroke as the input for a whole instruction. The keywords are printed on to a template which slips over the original keyboard.

There are three manuals for the Micro-Professor computer and a fourth which describes the Tiny Basic. The Micro-Professor manuals total 300 pages of information about the hardware, the software, and a series of experiments and other programs. What is there left to say about Oriental English?

The Micro-Professor manuals are no worse than many others and it is usually possible to figure out what the author intended to say. They are unsuitable for a first-time user who needs the constant reassurance of accurate documentation if she or he is to cope with unfamiliar and complex concepts.

The monitor listing is a fully-commented source listing and it would be very easy to modify the monitor by changing bytes here and there before "blowing" it into another EPROM.

The listing takes 51 pages for 2K and most of the useful subroutines start with a description of the function of the routine, a note of the input that is required, the output in various conditions, which of the Z-80 registers are corrupted and which other subroutines are called. The monitor and its documentation is up to the standard of one of the original Intel evaluation kits — very good.

The Experiment Manual covers the software and hardware and includes a full description of the CTC chip and its use. The Japanese English is much less severe in this book and I think that large sections have been written for native English speakers. The Users' Manual includes a full set of circuit diagrams for the computer and an adequate and reasonably well set-out explanation for each of the monitor commands.

One of the options for the Micro-Professor computer is an EPROM programmer board. The board is constructed to the same high standards as the main computer. A 40-way flat cable connects the EPROM board to the Micro-Professor and there is an extension socket on the second board to allow the Z-80 bus, now fully buffered, to be connected to additional equipment. The EPROM programmer will handle six types of EPROM and changes to the pin functions are made by the software — there are no "customising" plugs to lose. Clearly, once you have written and debugged your program, you can fix it in an EPROM and plug that into the spare socket on the main board. The programmer has a separate PSU for both the ordinary 5V supply and the 25V used for programming the EPROM chip.

CONCLUSIONS

- The Micro-Professor hardware is excellent, provided you can manage with the single-location, six-character display.
- The Z-80 CPU is a good microprocessor to program in machine code as the high-level instructions for Block Move and Compare operations, and the 16-bit register operations, allow more productive programming than the 6502.
- The plug connecting the 5V supply to the board became intermittent a couple of times and I would want to replace that with something more solid. With that exception I have nothing but praise for the hardware.
- Someone must be writing a Tiny Forth for the Micro-Professor. Rather than attempt to fit a limited and elementary Basic into the remaining space in the monitor I would like a series of useful subroutines — delays, PI/O control, printer interface, interrupt-driven timers working in the CTC, simple maths operators using RPN, and so on — which could be linked to form more complex modules within a user's programs.
- The Micro-Professor is both a serious tool and a lot of fun for anyone with an interest in low-level, real computing. I hope to buy a Micro-Professor and use it, battery-operated, on my commuter train. ■

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

ATOM UPGRADE

■ I am the owner of an Acorn Atom, and I am thinking of upgrading it to BBC Basic. If I did this, what could be done about the great difference in the keyboard?

Would the upgraded Atom then be able to use BBC software, and above all, how much does it cost and is it worthwhile?

Andrew Barlow,
Wardle,
Leicestershire.

THE FIRST THING to remember is that adding a BBC Basic ROM to your Atom will not turn it into a BBC Microcomputer. The ROM will not allow your Atom to load BBC software, and is not compatible with BBC graphics and sound. It costs around £50, and whether it is worth it or not depends on if you wish to use the computer primarily for things like games, where sound and graphics are important, or if your interests are more in the line of things which will be catered for by BBC Basic. The upgrade ROM does not demand a BBC keyboard, but is designed to use the standard Atom keyboard.

HARD TIME

■ I have been trying to work out a program for my ZX-81 to determine the time difference between two times such as 9.17 am and 3.34 pm, to work out which is earlier or later. I would be pleased if you could suggest an approach.

Malcolm Young,
Dunedin, New Zealand.

IT IS IMPORTANT to remember, in any program in which you are comparing quantities which are made up of units with different values such as pints and gallons, or hours and minutes, that the values to be compared must be rendered down to a single unit. You must also establish a common input format, so the computer knows what to expect. This can be done fairly easily with the ZX-81, because of its simple string handling. My suggested program follows. It needs input in the form 09.37 am or 12.04 pm. It then — line 40 — works out the value — as a number with a decimal point — of the time, adds 12 to the whole number to the left of the decimal point if the seventh element of the input string is a P, and then converts the number into minutes, comparing the two minutes' totals. The original strings are then used to print out the final information. A similar approach can be used when comparing quantities made up from units which are not exact multiples of 10 of each other. You will see that this program also allows you to work out the difference in minutes between two times, simply by subtracting one A(Z) from the other, and taking the ABS of the difference. Here is the program:

```
10 DIM A$ (2,8)
15 DIM A (2)
20 FOR Z=1 TO 2
30 INPUT A$ (Z)
40 LET A (Z)=VAL (A$(Z) (TO 5))
50 IF A$(Z,7)="P" THEN LET A
   (Z)=A (Z)+12
60 LET B=INT (A(Z))
70 LET A (Z)=60*B+100*A (Z)
   -60*B
80 NEXT Z
90 IF A (1) >A (2) THEN PRINT
   A$ (1);" IS LATER THAN ";
   A$ (2)
100 IF A (1) <A (2) THEN PRINT A$
   (1);" IS EARLIER THAN "; A$ (2)
```

LOOSE PLUG

■ In the August 1982 Response Frame, a letter was published from P Bradbery of Kent who wanted to know what to do about the loose 9V dc input plug on his Sinclair ZX-81.I have encountered this problem before, and solved it by opening up the computer and bending the metal strips on the input socket, so that the plug will fit into the socket. This repair will need to be carried out every few months, but is much quicker than buying a new socket as was suggested. I would also recommend that the plug should only be pulled out of the socket when necessary, because the more the plug is removed, the more often this repair will need to be carried out.

David Bluxton,
Lesbury, Alnwick.

THANKS FOR THE suggestion, which we are pleased to pass on to other readers who may be facing the loose input plug problem. But remember, this may infringe your guarantee.

PET TO ZX-81

■ I am trying to convert a program written for the Pet to run on my ZX-81. However, I have come across the following problem with a multi-line statement:

```
240 IF T=1 GOTO 270: L2 L*PC:
    LET L1=MB2
```

How would this be translated into ZX-81 Basic, taking into consideration the possibility that the answer may be true or false. What happens?

Martyn Brinton,
Harwich, Essex.

IF THE FIRST statement — the If — is found to be false, the computer moves automatically to the next line, so the rest of that line is not executed. You can solve this by either having a string of If/Thens, repeating the condition before each one, or by inverting the statement, so it reads:

```
IF T<>1 THEN LET L2=L*PC
IF T<>1 THEN LET L1=MB2
```

You could also follow through the line, working out what each element does in response to the first If/Then, and jump over the non-operative statements with the first If/Then. For example, your Pet program might read:

```
20 IF T=1 THEN Z=4: X=5
30 Y=2*Z+X
```

The ZX-81 version could be:

```
20 IF T<>1 THEN 25
21 Z=4
22 X=5
25 Y=2*Z+X
```

NO JOY

■ I bought a Commodore joystick to use with my Vic-20, but to my disappointment, there was no information on how to use it with the stick. I went back to the dealer, but he was not able to help me. How do I rewrite my programs to use the joystick? I am unable to break into commercial software programs to see how they do it.

Andrew Cunningham,
Coundon, Coventry.

COMMODORE HAS recently released a book, the *Programmer's Reference Guide* which explains on pages 246, 247 how the joystick works. It also gives a seven-line routine which reads the joystick, converting its output into numbers which you can add to Poke locations to move things on the screen. The book, which costs around £10, includes a wealth of other information, and would be a worthwhile purchase for anyone who is interested in serious programming on the Vic.

ADVENTUROUS

■ Would you please recommend a book on writing Adventure games. I would also like to know if the ZX Spectrum, which I intend to buy, would be suitable for this type of game, and if it is really suitable for a first-time user?

Gerard Hayes,
Finglas East, Dublin.

I DO NOT KNOW about any books primarily on writing Adventure games, although *Your Computer* runs articles on associated topics from time to time. However, there is one recently-published book *Dicing with Dragons* which explains the mechanics of role-playing games very well, and will give you many tips which you can convert to computer games. Other useful sources of ideas include the Puffin book *The Warlock of Firetop Mountain*, and the specialist magazines *The Gamer* and *The War Machine*. The latter is not a glossy magazine like *Your Computer*, but is photocopied each month, and you can get details from Emjay, 17 Langbank Avenue, Rise Park, Nottingham, NG5 5BU. The Spectrum 48K machine enables quite elaborate Adventure games to be constructed. The computer is suitable for a first-time user, so long as he or she is willing to take things slowly for the first few hours in finding his way around the keyboard.

VIEWDATA QUERY

■ I have recently ordered a ZX Spectrum and would like to know if I can receive Oracle and Ceefax on it. If so, how much would it cost?

A J Bolam,
Ryton, Tyne and Wear.

YOU CANNOT GET the BBC and ITV services that are transmitted along with the picture, via an external computer, without an extremely complex, and therefore unreliable and expensive, arrangement. There is little chance that anyone would bother trying to produce such a device, as you first need to receive the broadcast signal, interrupt it to extract and decode the Ceefax information, then feed it back into your television set. If, however, you are interested in Prestel, which is Ceefax-like information sent from a computer over the telephone lines, then the answer is "Yes, shortly". A number of firms, including Sinclair, are working on Prestel units.

COMBAT DURATION

■ Could you please tell me how to access the timer on the ZX-81, so it can be used in games to work out how long, for example, a player has managed to fight off the aliens?

John Maddock,
Holsworth, Devon.

THE FOLLOWING PROGRAM will emulate a stopwatch, and print the minutes and seconds elapsed. You can use parts of the program wherever needed. Note that the first two lines reset it, and must be included.

```
10 POKE 16436,255
20 POKE 16437, 255
30 LET TIME (65536 — PEEK 16436 —
   256*PEEK 16437)/50
40 PRINT AT 11, 12; INT(TIME/60);
   ":";INT(TIME−INT(TIME(60)
   *60);" "
50 GOTO 30
```

■

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Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

LAST MONTH saw the first large scale meeting of the newly-formed U.K. branch of the Hewlett-Packard PPC users' club. As many of you know, the PPC users' club has been very active in the States for quite a few years. It seems appropriate that HP-nuts now have an avenue for venting their energy. I hope to report some titbits from the day-long meeting in the next issue. But, be warned: the conversation became very esoteric at points.

Until then, if you are interested in the club and its newsletter, the man to contact is: D M Birch, Astage, Rectory Lane, Windlesham GU20 6BW.

My request for a larger variety of programs getting away from the war games idea has caused a welcome flood of more novel approaches. Long may it continue.

Firstly, canny scot Andrew Simpson from Perth feels that the program we published in the October issue was a bit naive. This was an attempt to approximate any irrational number by a series of more and more accurate fractions of rationals.

The following TI-58 program generates successive convergents of the development of R = a/b as a continued fraction, according to Euclid. To run it, enter R, press RST R/S.

For each convergent, the program displays the actual error E. To see a and b, press RCL 04 RCL 05. To see q, the next element of the continued fraction, press RCL 07. To continue, press R/S.

Note that R represents Real. In this respect, Roy Sirl's program is, of course, a misnomer. Whatever the value of the input number, it is by definition a rational number — even the Cray 2 can handle only rational approximations to irrational numbers — and it may well be equally important to know, for example, that:

R = a/b = 21649/513239 = 3/71

with an error of $7.2393/10^5$.

Note: a.b = $(10^{11} - 1)/9$. So, the idea that, in computer terms, irrationals are somehow different, is erroneous and generally misleading.

Incidentally, the Euclidean algorithm is ideal for finding the HCF of two integers a,b; the following program uses only one register. To run it, enter a, press RST R/S, enter b, press R/S (a and b may be entered in any order):

```
LOC
000 STO 1 2/CP ISBR
004 ( CE - ( CE ÷ RCL 1 )
    2/INT × RCL 1 )
018 2/X=T 0 26 2/EXC 1 GTO 0 04
026 RCL 1 R/S RST
```

For example, (958 581 817, 543 065 519) → HCF = 47293, 12 seconds. It is also the basis of a method of finding the general solution to a diophantine equation ax + by = c, but that is another story.

An intriguing calendar program has been written for the Casio 602 by D Cass of Stockport. The user operates the program by pressing P0. A prompt "Year?" is displayed and the user enters the year required. Pressing EXE sets the ball rolling and you are advised to go and have a cup of tea as printing takes about nine minutes.

The program works like the calendars found on watches. A fixed format, as shown in figure 1, is used and the days of the week adjusted accordingly. The 31, 30 or 29 on the

(continued on next page)

Source: The Universal Encyclopedia of Mathematics (Pan)

Euclid's Algorithm: Every rational number a/b can be developed as a continued fraction:

$$a/b = q_0 + \cfrac{1}{q_1 + \cfrac{1}{q_2 + \cdots \cfrac{}{q_{n-1} + \cfrac{1}{q_n.}}}}$$

$$\begin{array}{llllll} \text{where: } & a & - & q_0.b & = & r_1 \\ & b & - & q_1.r_1 & = & r_2 \\ & r_1 & - & q_2.r_2 & = & r_3 \\ & r_{n-2} & - & q_{n-1}.r_{n-1} & = & r_n \\ & r_{n-1} & - & q_n.r_n & = & 0. \end{array}$$

i.e. for all rational numbers — and all rational approximations to irrational numbers — the remainder tends to 0.

The Program:

Part 1 (000-015) initialises the variables:

$R_{00} = R$; $R_{01} = a_{n-2} = 0$; $R_{04} = a_{n-1} = 1$

$R_{02} = b_{n-2} = 1$; $R_{05} = b_{n-1} = 0$

$R_{03} = r_{n-2} = R$; $R_{06} = r_{n-1} = 1$; $R_{07} = q_{n-1}$

Part 2 (016-035) evaluates the nth term of Euclid's algorithm:

$r_n = r_{n-2} - q_{n-1}.r_{n-1}$ where: $q_{n-1} = \text{INT}(r_{n-2}/r_{n-1})$

Part 3 (036-064) evaluates the elements of the nth convergent:

$a_n = a_{n-2} + q_{n-1}.a_{n-1}$; $b_n = b_{n-2} + q_{n-1}.b_{n-1}$

Part 4 (065-end) calculates and displays the actual error of the nth convergent:

$E_n = (a_n/b_n) - R.$

The generations are updated during processing, i.e. a_n and b_n are in R_{04} and R_{05}, r_n is in R_{06}. The nth term of the continued fraction, q_{n-1} is in R_{07}.

Note that if R<1, q_0 = 0.

and that $b > r_1 > r_2 > r_3 > \ldots > r_n > 0$

TI-58 Euclidean convergence program by A M Simpson.
(Evaluates successive convergents a_n/b_n for Real number R)

KEY	LOC	CODE	KEY	LOC	CODE
STO	000	42	(	036	53
0	001	00	RCL	037	43
STO	002	42	1	038	01
3	003	03	+	039	85
CLR	004	25	RCL	040	43
STO	005	42	4	041	04
1	006	01	STO	042	42
STO	007	42	1	043	01
05	008	05	×	044	65
1	009	01	RCL	045	43
STO	010	42	7	046	07
2	011	02	)	047	54
STO	012	42	STO	048	42
4	013	04	4	049	04
STO	014	42	÷	050	55
6	015	06	(	051	53
RCL	016	43	RCL	052	43
3	017	03	2	053	02
–	018	75	+	054	85
(	019	53	RCL	055	43
CE	020	24	5	056	05
÷	021	55	STO	057	42
RCL	022	43	2	058	02
6	023	06	×	059	65
)	024	54	RCL	060	43
2nd INT	025	59	7	061	07
STO	026	42	)	062	54
7	027	07	STO	063	42
×	028	65	5	064	05
RCL	029	43	–	065	75
6	030	06	RCL	066	43
=	031	95	0	067	00
2nd EXC	032	48	=	068	95
6	033	06	R/S	069	91
STO	034	42	GTO	070	61
3	035	03	0	071	00
			16	072	16

(continued from previous page)

rightmost column are removed according to the month being printed and whether the year is a leap year or not.

1.	08	15	22	29
2.	09	16	23	30
3.	10	17	24	31
4.	11	18	25	
5.	12	19	26	
6.	13	20	27	
7.	14	21	28	

Figure 1.

Zeller's Congruence is used to find the day of January 1, knowing the year. Knowing this P9 prints out the name of the day. The data for the printing of the actual month itself is held in memories 10-16. Each memory holds the information to print one row; there are seven rows in all — see figure 1.

The data is decoded by masking the integer part of the number, printing it, removing it from the original number, then multiplying by 100 to reveal the next number. For example, the first row is held in memory 10, that is, M10 = 1.08152229. Removing the integer part gives 1, subtracting from the original number leaves 0.08152229. The 1 is printed, and the remainder multiplied by 100, giving 8.152229. The process is repeated until zero is reached, and the next day and row dealt with. P2 takes care of the removal of the 29, 30 and 31 from memories 14, 15 and 16 respectively — depending on the month. Copies of memories 14, 15 and 16 are held in 17, 18 and 19 so the original contents can be replaced at the start of printing each new month. P6 and P7 takes care of printing the names of each month. P0 handles all the dirty work.

```
PROGRAM LIST
M00-19,F-1F 512steps

*** P0
0 Min09
"YEAR ?"
HLT
"    CALENDER :#"
GSBP4
÷ 2 10ˣ = Min03 INT
Min04 M-03
MR03 x 2 10ˣ = Min03
- ( MR03 ÷ 4 ) INT x
4 = x=0 GOTO3
MR04 - ( MR04 ÷ 4 )
INT x 4 = x=0 GOTO3
1 Min1F GOTO4
LBL3
0 Min1F
LBL4
1 M-03
29 + MR03 + ( MR03 ÷
4 ) INT + ( MR04 ÷ 4
) INT - 2 x MR04 =
Min00 - ( MR00 ÷ 7 )
INT x 7 = Min01
1 Min02
LBL5
GSBP6
MR09 +
GSBP1
GSBP2
10 Min00
LBL6
GSBP9
IND MR00 Min06
LBL7
INT
";## "
M-06
MR06 x 2 10ˣ = Min06
x=0 GOTO8
GOTO7
LBL8
";"
GSBP4
1 M+00 M+01
GSBP1
MR00 - 17 = x=0
GOTO9
GOTO6
LBL9
1 M+02
MR02 - 13 = x=0
GOTO0
GOTO5
LBL0
          ...176steps

*** P1
MR01 = ÷ 7 = FRAC x
7 = Min01
          ...011steps

*** P2
3 Min09
MR17 Min10
MR18 Min11
MR19 Min12
MR02 - 2 = x=0 GOTO4
MRF - 31 = x=0 GOTO5
GOTO3
LBL5
3 Min09 GOTO1
LBL4
MR1F x=0 GOTO2
1 M-09
2.9 EXP 7 +/- M-10
LBL2
1 M-09
3 EXP 7 +/- M-11
LBL3
1 M-09
3.1 EXP 7 +/- M-12
LBL1
          ...059steps

*** P4
SAVE invEXE
          ...003steps

*** P6
" "
GSBP4
"    "
10 MinF
MR02 x≥F GOTO0
IND GOTO2
LBL1
";January"
31 MinF GOTO0
LBL2
";February"
28 MinF GOTO0
LBL3
";March"
31 MinF GOTO0
LBL4
";April"
30 MinF GOTO0
LBL5
";May"
31 MinF GOTO0
LBL6
";June"
30 MinF GOTO0
LBL7
";July"
31 MinF GOTO0
LBL8
";August"
31 MinF GOTO0
LBL9
";September"
30 MinF
LBL0
MR02 x≥F
GSBP7
";"
GSBP4
" "
GSBP4
          ...154steps

*** P7
9 M-02 IND GOTO2
LBL1
";October"
31 MinF GOTO0
LBL2
";November"
30 MinF GOTO0
LBL3
";December"
31 MinF
LBL0
9 M+02
          ...054steps

*** P9
IND GOTO1
LBL0
"Sun"
GOTO9
LBL1
"Mon"
GOTO9
LBL2
"Tue"
GOTO9
LBL3
"Wed"
GOTO9
LBL4
"Thu"
GOTO9
LBL5
"Fri"
GOTO9
LBL6
"Sat"
LBL9
          ...052steps

MEMORY LIST
M00-19,F-1F 512steps
M00=          17.
M01=           3.
M02=          13.
M03=          81.
M04=          19.
M05= 3.141592654
M06=           0.
M07= 3.141592654
M08= 3.141592654
M09=           3.
M0F=          31.
M10=  1.08152229
M11=   2.0916233
M12=  3.10172431
M13=    4.111825
M14=    5.121926
M15=    6.132827
M16=    7.142128
M17=  1.08152229
M18=   2.0916233
M19=  3.10172431
M1F=           1.
```

D Cass of Stockport's calendar program.

Finally, Albert Bale of Warrington appears relieved that we have programs for the more modest CBM PR-100.

This normal distribution program computes the area under a normal distribution curve from k to infinity, where k can take any value above or equal to the mean of the distribution. Since the curve is symmetrical about μ, and since the total area is 1, any area can be found.

If the distribution of interest has a mean and standard deviation, and the value from which the area is required is k as above, then load the program and calculate manually

$\left(\frac{k-\mu}{\delta}\right) \times \frac{331}{2} + 165$ Enter the fractional part in M1 and the integer part in M2. Enter 4.3756634×10^{-2} in M3. This is $\frac{C^{331}_{166}}{2^{331}}$ the distribution using $(\frac{1}{2}+\frac{1}{2})^{331}$ — the values chosen to give the best accuracy without overflowing the machine capacity.

Run from 00. The required area is displayed when the program stops. If the required area was that up to k from -00 then subtract the result from 1. For a standard normal distribution $\mu = 0$ and $\delta = 1$ so $\frac{k-n}{\delta} = k$

The program is generally accurate to four places of decimals.

A population of manufactured items has weights which are normally distributed about a mean of 100gm., with a standard deviation of 10gm.

Find the proportion of items which have weights between 70gm. and 80gm.

Now the program only computes areas for values above the mean, but since normal distributions are symmetrical, a similar area lies between 120 and 130gm. So we compute the areas from 120gm. to 00 and from 130gm. to 00, and the required area is the difference between these areas.

For the first value, 120gm., k = 120, so computing

$$\left(\frac{k-\mu}{\delta} \times \sqrt{\frac{331}{2}} + 165\right)$$

gives 183.1934. The fractional part goes in M1 and the integer part in M2. A useful key sequence is M 1 F INT M 2 MR 1 F FRAC M 1

Store 4.3756634×10^{-2} in M3 and run from 00. An area of 0.02277 is given. Repeating for 130gm. — no need to reload M3 or Goto 00 manually, the program does this — gives an area of 0.00134. Values far from the mean take a long time to run. Hence the required area is 0.0214, that is, a proportion of 2.14 percent.

Albert Bale's normal distribution program.

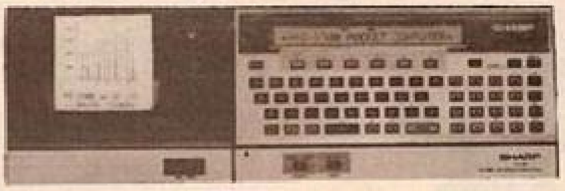
	0-	1-	2-	3-	4-	5-	6-	7-
-0	1	6	2	F	6	MR	0	9
-1	6	MR	÷	M–	6	3	MR	
-2	5	1	(	2	=	-	9	
-3	-	X	MR	=	SKIP	.	GOTO	
-4	MR	(	2	M	GOTO	5	1	
-5	2	3	+	9	6	=	3	
-6	=	3	1	MR	1	±	MR	
-7	SKIP	1	=	2	MR	R/S	1	
-8	GOTO	-	+	-	9	GOTO	GOTO	
-9	6	MR	1	1	X	0	4	

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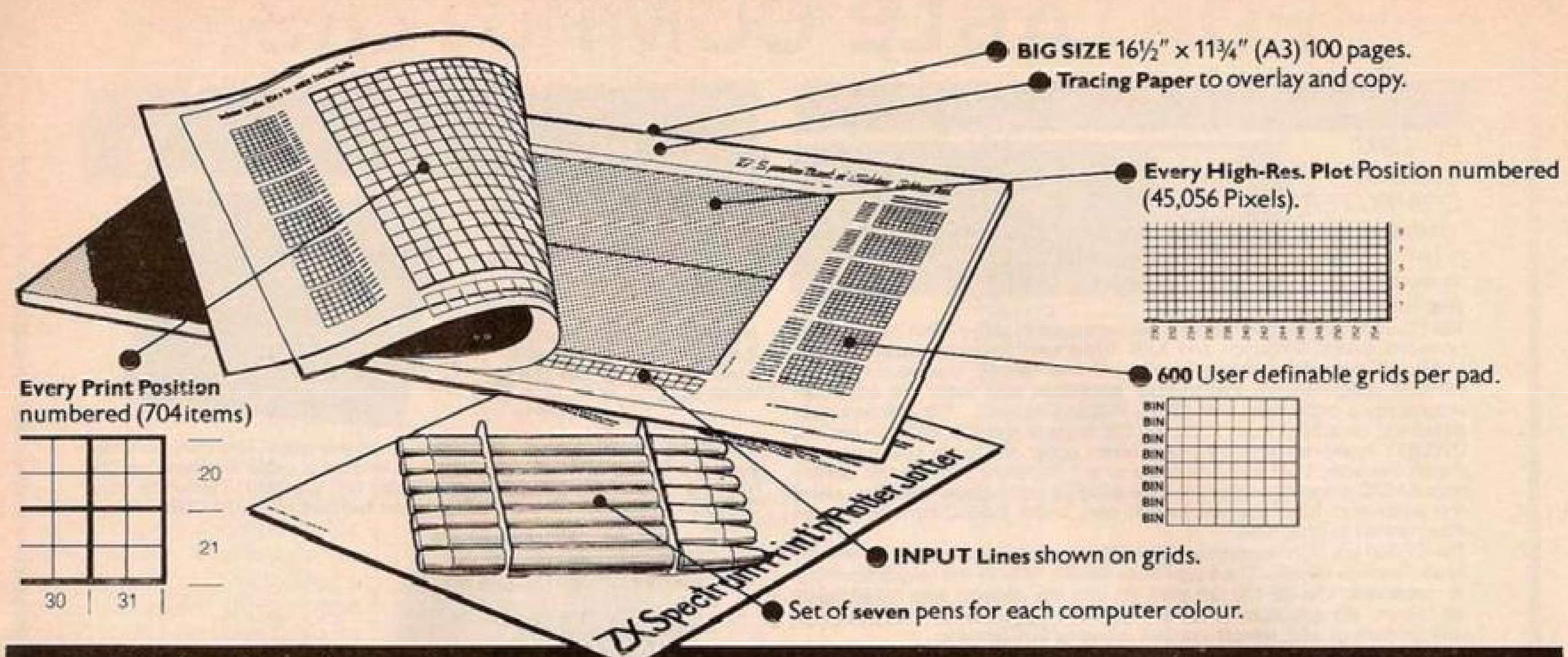
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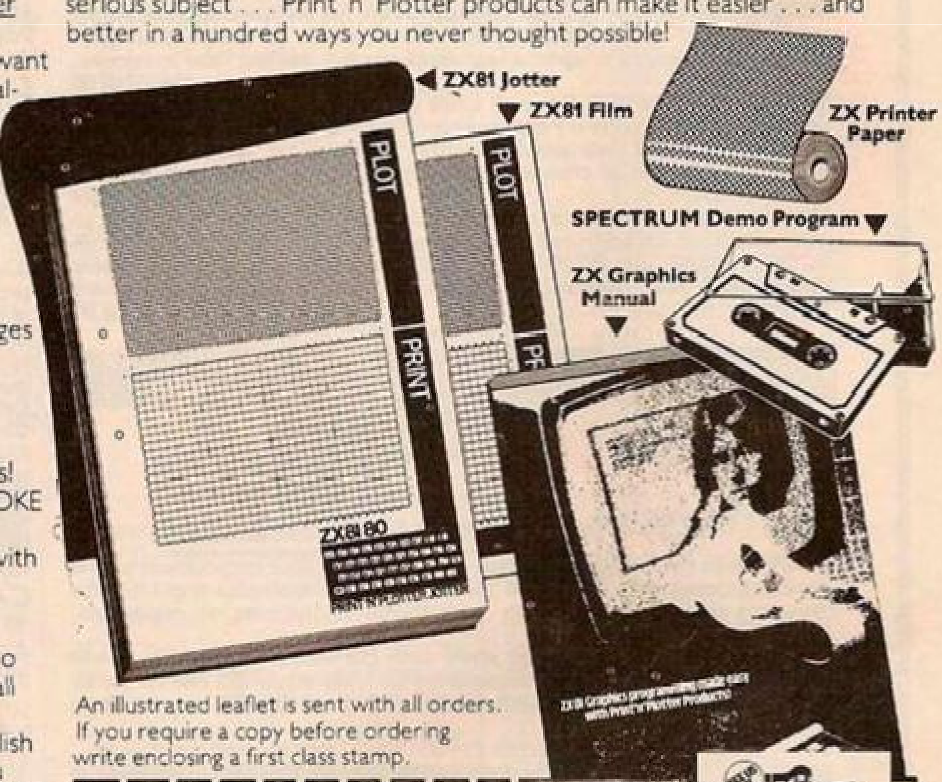
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Three games

C G Brown,
Sutton Coldfield,
West Midlands.

ZX-81

HERE ARE three programs, Raid, Freedom, and Escape. Documentation and explanations on how each program runs, what to do and the object of each game, appear after the program's listing. They are all 1K games. First, Raid:

```
  1 LET S=0
  2 LET Z=13
  3 LET L=2
  4 LET C=1
  5 LET B=20
 10 CLS
 20 PRINT AT B,Z;"*";AT L,C;"Graphic
      Shift R,G,E.";AT 21,Z-1;"Graphic
      Shift W,F, Q.";AT 17,10;"Graphic Shift
      7,7,7,7,7,7,7,"
 30 IF INKEY$="0" AND B < 17 THEN STOP
 40 IF INKEY$ <> "0" THEN LET B=B-1
 50 IF B < 0 THEN LET B=20
 60 IF C=29 THEN GOSUB 200
 70 LET C=C+1
 80 IF B=L AND C+1=Z THEN GOSUB 190
 90 IF L= > 19 THEN PRINT AT 0,0;S
100 IF L= > 19 THEN STOP
110 GOTO 10
190 LET S=S+1
195 LET B=20
200 LET L=L+1
210 LET C=0
220 RETURN
```

When the game starts, you must press 0. When you release 0, your missile will rise to the top of the screen. It will then reappear at the bottom of the screen. The object is to shoot each invader, so you have a high score when the invader finally reaches the bottom of the screen. You must not press 0 after your missile has passed the Graphic Shift 7s, or the game will stop. The game takes a fair amount of practice, before you know exactly when to release your missile, represented by an*. The second game is called Freedom.

```
  1 LET L=10
  2 LET C=13
  3 LET A=RND*21
  4 LET B=RND*28
  5 LET S=0
 10 CLS
 15 PRINT AT A,B;"Graphic Shift A,D,A."
 20 PRINT S
 25 LET S=S+1
 30 LET C=C+(INKEY$="8") -
      (INKEY$="5")
 35 LET L=L+(INKEY$="6") -
      (INKEY$="7")
 40 IF RND>.5 AND(L=A-1 AND C=B
      +1)THEN STOP
 50 PRINT AT L,C;"Inverse :"
 55 IF L=A AND C=B+1 THEN GOSUB 100
 60 GOTO 10
100 PRINT "SUCCESS"
110 STOP
```

You have been sent to rescue your leader, who has been taken captive by the enemy. He has been brought to the enemy's floating palace, the entrance to this being at the top. Press the arrows above the keys 5 to 8 to move. You must enter at the top in the middle. Finally, Escape.

```
  1 LET L=VAL "15"
  2 LET C=L
  3 LET A=VAL"3"
  4 LET B=VAL"12"
  5 LET S=PI-PI
 20 PRINT AT VAL"15",VAL"10";"
      (11 Inverse Spaces)"
 30 PRINT AT SGN PI,VAL"13";"Graphic
      Shift E,7,7,R"
 40 PRINT AT L,C;"Inverse 0"
 50 LET L=L+(INKEY$="6")
 60 LET C=C+(INKEY$="8") -
      (INKEY$="5")
 70 LET L=L-SGN PI
 80 LET S=S+SGN PI
 90 IF L< SGN PI THEN LET L=PI-PI
100 PRINT AT A,B;"Graphic Shift A,H,A,
      H,A,H.";AT A+1,B;"Graphic Shift
      H,A,H,A,H,A."
110 LET I=INT(RND * 5)+SGN PI
120 LET A=A+(I=1)-(I=VAL"2")
130 LET B=B+(I=VAL"3") - (I=VAL
      "4")
140 IF A > VAL "12" THEN LET A=VAL
      "13"
150 IF L=A OR L=A+1 AND (B=C OR C=
      B+1 OR C=B+2 OR C=B+3 OR C=
      B+4 OR C=B+5) THEN STOP
160 PRINT AT PI-PI,PI-PI;S
170 IF L=SGN PI AND C > VAL "13" AND
      C< VAL "16" THEN STOP
180 CLS
190 GOTO 20
```

You must escape through the goal at the top of the screen. You must dodge the set of characters moving randomly. You automatically move up. To counteract this you must press 6.

Sub attack

Paul Sellin,
Bristol,
Avon.

SPECTRUM

THIS PROGRAM takes 6.8K RAM including variables, and so will fit easily into the smaller version of the Spectrum. The object of the game is to steer the submarine through a narrow channel, with the use of the cursor left and cursor right keys.

You have five lives and must avoid the guns on either bank. Anti-submarine booms appear at random — it is occasionally possible to slip through them. Fuel is consumed at the rate of one unit per screen length. A lot is lost if you run aground, or if you are hit. The game will end when the fuel runs out.

In an emergency you can stop the sub, by using the cursor down key: number 6. This also uses up a lot of fuel. The player wins the game by travelling for 10 miles.

The small user-defined graphics loader program can either be run separately, or can be made a part of the main program. Lines 90-99 can be omitted, as can lines 5000-5300 which are only an introduction. If, when Saving, "Line 99" is typed after the program name, the program should auto-start on Loading.

```
  10 REM    User Graphics Loader
            for Submarine Attack
  12 REM
  14 REM              XS
  16 REM
  18 REM
  20 FOR f=1 TO 3
  25 READ z
  30 FOR n=0 TO 7
  35 READ a
  40 POKE USR (CHR$ z)+n,a
  45 NEXT n
  50 NEXT f
  55 DATA 144,66,60,60,60,90,24,
24,24
  60 DATA 145,24,24,24,90,60,60,
60,66
  65 DATA 150,153,90,60,255,255,
60,90,153
  90 REM ** Submarine Attack **
  92 REM
       (First load User Graphics)
  93 REM
  94 REM              (XS)
  95 REM
  96 REM
  99 GO SUB 5000
 100 BORDER 0: PRINT AT 11,7;"An
y key to start": PAUSE 0: CLS :
LET h=0: LET v=0: LET x=15: LET
r=60: LET bm=0: LET bml=0: LET d
ir=0: LET tot=-1: LET tos=1: LET
 xtos=0: LET t=0: LET scr=0: LET
 tor=4: LET fuel=0: LET gun=0: L
ET gunr=-1: LET gunl=-1: LET orn
dl=0: LET orndr=0: LET boom=0
 101 DIM G$(2): DIM f$(3): LET f
$="200"
 107 DIM T$(2,12): LET T$(1)="GU
N TO LEFT": LET T$(2)="GUN TO RI
GHT"
 108 LET S$="BOOM AHEAD"
 109 LET g$(1)="A": LET g$(2)="B
"
 110 PLOT tos,r+1: DRAW 15,0
 120 PLOT tos,r : DRAW 16,0
 130 PLOT tos,r-1: DRAW 16,0
 150 PLOT 0,120: DRAW 255,0
 151 FOR n=121 TO 126
 152 PLOT 0,n: DRAW 255,0
 153 NEXT n
 160 PRINT AT 1,0;"FUEL:
     HAZARDS"
 165 PRINT AT 3,0;"MILES:"
 170 PRINT AT 1,6;f$
 220 FOR n=7 TO 9
 225 INK 4: PRINT AT n,0;"
"
 230 NEXT n
 235 FOR n=19 TO 21
 240 PRINT AT n,0;"
"
 245 NEXT n: INK 0
1010 IF tos<=1 THEN GO TO 1015
1011 IF POINT (tos+13,r+2)=1 THE
N GO TO 3000
1012 IF POINT (tos+14,r+2)=1 THE
N GO TO 3000:
1013 IF POINT (tos+15,r+2)=1 THE
N GO TO 3000
1014 IF POINT (tos+12,r+2)=1 THE
N GO TO 3000
1015 LET boom=boom-1: LET tot=to
t+1: IF tos>210 THEN LET tos=1:
LET scr=scr+1: LET xtos=1: LET f
uel=fuel-1: LET otos=tos
1020 IF INKEY$="" THEN LET p=r:
GO TO 1045
1030 LET t=VAL INKEY$
1032 LET p=r
1033 IF tos=196 THEN LET t=0
1034 IF t=5 THEN LET r=r+6
1035 IF r>=93 THEN LET r=r-6: GO
 TO 1045
1036 IF t=8 THEN LET r=r-6
1041 IF r<=29 THEN LET r=r+6
1042 IF t=6 THEN LET tot=tot-1:
LET tos=tos-15: LET fuel=fuel-5:
 GO TO 1200
1045 IF xtos=1 THEN OVER 1: PLOT
 otos,p: DRAW 16,0: PLOT otos,p-
1: DRAW 15,0: PLOT otos,p+1: DRA
W 15,0: OVER 0
1046 OVER 1: PLOT tos,p: DRAW 16
,0: PLOT tos,p-1: DRAW 15,0: PLO
T tos,p+1: DRAW 15,0: OVER 0
1048 PLOT tos+15,r: DRAW 16,0: P
LOT tos+15,r+1: DRAW 15,0: PLOT
tos+15,r-1: DRAW 15,0
1049 IF tos>195 THEN OVER 1: PLO
T tos+15,p: DRAW 16,0: PLOT tos+
15,p-1: DRAW 15,0: PLOT tos+15,p
+1: DRAW 15,0: OVER 0
1200 INK 2: PRINT AT 1,6;f$: INK
 0
1210 IF xtos=1 THEN LET h=(INT (
tot/32))/2: PRINT AT 3,6;"   ":
 PRINT AT 3,6;h
1250 IF gunl<1 AND gunr<1 THEN G
O TO 1255
1251 LET gunl=gunl-1: LET gunr=g
unr-1: GO TO 1275
1255 IF gunl=0 OR gunr=0 THEN GO
 TO 1300
1256 LET rnd=RND: IF rnd>.4 THEN
 GO TO 1260
1257 GO TO 1500
```

(continued on next page)

(continued from previous page)

```
1260 IF rnd>0.7 THEN PAPER 4: LE
T gunl=8: LET orndl=RND*20+5: PR
INT AT 8,orndl;g$(1): PAPER 7: G
O TO 1500
1265 PAPER 4: LET orndr=RND*20+5
: PRINT AT 20,orndr;g$(2): LET g
unr=8: PAPER 7
1270 GO TO 1600
1275 IF gunl>0 THEN LET rndl=RND
*5+10: PRINT AT rndl,orndl;"G"
1277 IF gunr>0 THEN LET rndr=RND
*5+13: PRINT AT rndr,orndr;"G"
1279 GO TO 1500
1280 INK 4: PRINT AT 8,orndl;"■"
: PRINT AT 20,orndr;"■": INK 0
1300 IF gunl=0 THEN FOR n=1 TO 6
: PRINT AT n+9,orndl;" ": NEXT n
: LET gunl=-1: INK 4: PRINT AT 8
,orndl;"■": INK 0
1310 IF gunr=0 THEN FOR n=1 TO 6
: PRINT AT 12+n,orndr;" ": NEXT
n: LET gunr=-1: INK 4: PRINT AT
20,orndr;"■": INK 0
1505 IF boom<0 THEN IF RND>0.75
THEN LET boom=10: GO TO 1520
1510 GO TO 1550
1520 LET bm=RND*200+40: LET bml=
RND*40+16
1530 LET dir=RND
1535 IF dir>0.5 THEN PLOT bm,25:
 DRAW 0,bml: GO TO 1600
1540 PLOT bm,95: DRAW 0,-bml
1545 GO TO 1990
1560 IF boom=0 THEN GO TO 1570
1565 GO TO 1990
1570 IF dir>0.5 THEN PLOT bm,25:
 DRAW 0,bml: OVER 1: PLOT bm,25:
 DRAW 0,bml: OVER 0: GO TO 1600
1580 PLOT bm,95: DRAW 0,-bml: OV
ER 1: PLOT bm,95: DRAW 0,-bml: O
VER 0
1600 FLASH 0: PRINT AT 2,14;"
     ": PRINT AT 3,14;"
     "
1610 IF gunl>=0 THEN FLASH 1: PR
INT AT 2,16;t$(1)
1620 IF gunr>=0 THEN FLASH 1: PR
INT AT 2,15;t$(2)
1630 IF boom>0 THEN FLASH 1: PRI
NT AT 3,16;s$
1700 IF r<37 OR r>83 THEN GO TO
1720
1710 GO TO 1990
1720 LET u=RND: IF u>0.5 AND u<0
.7 THEN GO TO 4500
1990 FLASH 0: INK 0: LET l=0: LE
T tos=tos+15
1992 IF VAL f$<1 THEN GO TO 3500
1993 IF h>=10 THEN GO TO 4000
1995 IF xtos=1 THEN LET fuel=(VA
L f$)+fuel: LET f$=STR$ fuel: LE
T xtos=0: LET fuel=0
1999 GO TO 1010
3000 BEEP .5,12
3005 LET v=v+1
3007 PRINT AT 2,14;"
     "
3010 FLASH 1: PRINT AT 2,16;"  C
RASH!!  "
3020 IF v<5 THEN PRINT AT 3,16;"
 FUEL LOST ": LET fuel=-20
3030 IF v=5 THEN PRINT AT 3,16;"
 SUB SUNK! ": GO TO 3530
3035 FOR F=1 TO 200: NEXT F
3036 FLASH 0
3037 PRINT AT 2,14;"
 ": PRINT AT 3,14;"
 "
3040 PRINT AT 21,0;"LIVES LEFT="
;5-v: GO TO 1015
3500 BEEP .5,12
3510 PRINT AT 2,14;"
": PRINT AT 3,14;"
 "
3520 FLASH 1: PRINT AT 2,18;"NO
FUEL";: FLASH 0: PRINT "    ": F
LASH 1
3530 PRINT AT 9,6;"   GAME  OVER
  ": FLASH 0
3535 FOR N=24 TO 12 STEP -0.5: B
EEP .01,N: NEXT N: FOR n=1 TO 30
0: NEXT n: CLS : GO TO 100
3540 FOR F=1 TO 300: NEXT F
4000 FOR n=1 TO 24: BEEP 0.005,n
: NEXT n
4010 INK 4: PAPER 1: FLASH 1: PR
INT AT 9,6;"MISSION ACCOMPLISHED
!"
4020 BEEP 5,24
4030 FLASH 0: PAPER 7: INK 0: PR
INT AT 11,4;"    YOU ARE PROMOTE
D-          TO ANOTHER MISSI
ON!"
4035 FOR N=1 TO 200: NEXT N
4040 RUN
4500 BEEP 0.5,24
4510 PRINT AT 2,14;"
  ": PRINT AT 3,14;"
  "
4520 FLASH 1: PRINT AT 2,16;"RUN
 AGROUND"
4530 PRINT AT 3,16;" LOSE FUEL
"
4535 LET fuel=fuel-20
4536 FOR n=1 TO 200: NEXT n
4537 FLASH 0: PRINT AT 2,14;"
           ": PRINT AT 3,14;"
           "
4540 GO TO 1990
5000 BORDER 1: CLS
5010 LET d$="   SELLIN SOFTWARE
PRESENTS: "
5020 FOR f=29 TO 1 STEP -1
5030 LET e$=D$(f TO 29)
5040 INK 3: PRINT AT 10,0,e$
5045 FOR g=1 TO 10: NEXT g
5050 NEXT f
5060 FOR f=10 TO 2 STEP -1
5065 PRINT AT f,0;e$
5070 PRINT AT f+1,0;"
 "
5075 PAUSE 10: NEXT f
5080 LET d$="      SUBMARINE ATTA
CK        "
5085 FOR f=1 TO 29
5090 LET e$=d$(1 TO f)
5100 INK 2: PRINT AT 10,32-f,e$
5110 NEXT f
5120 FOR n=12 TO 21
5125 PAPER 5: PRINT AT n,0;"
 "
5130 NEXT n
5140 INK 7
5150 PLOT 30,20: DRAW 176,0: DRA
W 2,2: DRAW 0,11: DRAW -60,5: DR
AW -30,0: DRAW 0,15: DRAW -1,1:
DRAW -3,0: DRAW -1,-1: DRAW 0,-1
5: DRAW -25,0: DRAW -60,-5: DRAW
 0,-11: DRAW 2,-2: PLOT 115,54:
DRAW 0,5: DRAW 1,0
5160 PAPER 7: INK 0
5170 FOR n=1 TO 400: NEXT n
5300 GO TO 100
```

Sorcerer's castle

Stuart Sly,
Walsall,
West Midlands.

BBC

THIS PROGRAM is a fairly simple but impressive demonstration of some of the sound and graphics capabilities of the BBC Micro.

The program draws a castle on a hill which, by use of the VDU19 command, is made to appear instantly. There is first a thunderstorm which illuminates the castle with lightning. At midnight the old clock chimes out the hours disturbing a bat which flies out of one of the towers.

Finally ProcEnd gives a dramatic sonic and graphic finale to the program but if you have enough memory you could extend the program.

Lines 40-110 draw out the castle but by setting all the colours to blue in line 30 this cannot be seen. Line 120 sets the normal colours and the castle appears as if by magic.

The VDU19 command is used again for the effects during the lightning. Line 160 uses sound channel 0 to give the thunder. Line 170 sounds the clock's chimes using the envelope defined in line 10.

Lines 180-290 give the logic for the bat's flight. Lines 300-360 are subroutines for the bat, the flashing light and the lightning. Both programs were written on a BBC Model A but should run easily on a Model B.

```
10ENVELOPE4,4,0,0,0,0,0,0,126,-5,-3,-1,126,110
20MODE5:L=0:A=409:B=640:BAT=1
30VDU19,0,4,0,0,0,19,3,4,0,0,0,19,2,4,0,0,0,19,1,4,0,0,0:GCOL0,3
40MOVE100,0:DRAW1150,0:PLOT85,330,400:PLOT85,900,400:MOVE1000,200:DRAW1040,240:PLOT85,1080,80
50MOVE1060,80:DRAW200,280:PLOT85,220,200:GCOL0,3:MOVE370,590:DRAW330,400:PLOT85,510,590:PLOT85,600,400
60MOVE870,590:DRAW900,400:PLOT85,730,590:PLOT85,600,400:DRAW720,560:PLOT85,520,560:MOVE390,590
70DRAW490,590:PLOT85,440,760:DRAW440,800:MOVE750,590:DRAW850,590:PLOT85,800,760:DRAW800,800
80MOVE680,560:DRAW580,560:PLOT85,620,820:DRAW620,870:GCOL0,2:MOVE420,440
90DRAW420,500:PLOT85,460,440:PLOT85,460,500:MOVE780,440:DRAW780,500:PLOT85,820,440:PLOT85,820,500:MOVE790,620:DRAW790,660:PLOT85,810,620
100PLOT85,810,660:MOVE430,620:DRAW430,660:PLOT85,450,620:PLOT85,450,660:MOVE620,700:DRAW620,730:PLOT85,630,700:PLOT85,630,730
110MOVE620,460:DRAW620,360:MOVE620,460:DRAW660,420:DRAW660,360:MOVE620,460:DRAW580,420:DRAW580,360:DRAW660,360
120VDU19,1,3,0,0,0,19,3,0,0,0,0,19,2,3,0,0,0:TIME=0:REPEATUNTILTIME>200
130FOR K=0TO2
140FOR M=1 TO4
150GCOL0,1:PROCLIGHTNING:VDU19,3,7,0,0,0,19,2,0,0,0,0:GCOL0,0:PROCLIGHTNING:VDU19,3,0,0,0,0,19,2,3,0,0,0:NEXT M
160SOUND0,-15,6,30:FOR S=-15 TO 0:SOUND 0,S,6,2:NEXTS,K
170PRINTTAB(4,2);"MIDNIGHT!!!":GCOL0,1:VDU19,1,14,0,0,0:PROCWINDOW:FOR L=1 TO 12:SOUND2,4,5,20:TIME=0:REPEATUNTILTIME>200:NEXT L
180GCOL0,3:SOUND1,-10,RND(5)+245,5:IF BAT=0 GOSUB300
190FORT=0TO300:NEXT
200GCOL0,0:GOSUB300
210GCOL0,3
220A=A-24:B=B-10:IF A=-23 THEN PROCend
230IF BAT=1 GOSUB310
240FORT=0TO300:NEXT
250GCOL0,0:GOSUB310
260GCOL0,3:MOVE420,680:DRAW390,590:PLOT85,420,590:GCOL0,2:PROCWINDOW
```

```
270GCOL0,3
280A=A-24:B=B-10:IF A=
-23 THEN PROCend
290GOTO180
300MOVE A,B:DRAW(A+15)
,B:BAT=1:RETURN
310MOVEA,(B+12):DRAW(A
+7),B:DRAW(A+15),(B+12):
BAT=0:RETURN
320DEFPROCWINDOW:MOVE4
30,620:DRAW430,660:PLOT8
5,450,620:PLOT85,450,660
:ENDPROC
330DEFPROCend:VDU19,0,
19,0,0,0:FORS%=1TO255:SO
UND1,-15,S%,2:SOUND2,-15
,S%+100,3:SOUND3,-15,255
-S%,4:NEXT:STOP:ENDPROC
340DEFPROCLIGHTNING
350MOVE1200,1000:DRAW1
020,900:DRAW860,730:MOVE
900,750:DRAW960,860:DRAW
920,570:MOVE930,800:DRAW
890,590
360MOVE1080,930:DRAW10
50,760:DRAW1080,690:MOVE
1060,800:DRAW1000,750:DR
AW980,700:MOVE1000,870:D
RAW810,820:MOVE830,820:D
RAW830,790:ENDPROC
```

Bomber

K A Mair,
Tattershall,
Lincolnshire.

VIC-20

THIS PROGRAM runs on unexpanded Vic-20 in about 2K. All instructions are included in the program, shown on the right.

```
1 REM*BOMBER*
5 GOSUB2000
10 POKE36879 9:DEFFNA(X)=INT(RND(1)*X)+1:PRINT"J"
19 REM*DRAW BUILDINGS*
20 FORB=8142TO8163:BD=102
30 FORBE=BTOB-FNA(X)*22STEP-22
40 POKEBE,BD:NEXTBE,B
50 FORBF=8164TO8185:FORBG=38884TO38905
60 POKEBF,160:POKEBG,6:NEXTBG,BF
99 REM*A/C*
100 A=7680:AC=62:SP=32
110 POKEA,AC:POKEA 1,SP
115 IF EEK(A+1)=102THEN1500
116 IFA=8163THEN2500
119 REM*CHECK FOR BOMB*
120 GETA$:IFA$="F"THENGOSUB1000
130 A=A+1:FORW=1TO100:NEXTW:GOTO110
999 REM*DROP BOMB*
1000 C=A+22:CB=46
1010 POKEA,AC:POKEA-1,SP:POKEC,CB:POKEC-22,SP
1015 IFPEEK(A+1)=102THEN1500
1020 A=A+1:C=C+ 2
1025 F RW=1TO100:NEXTW
1030 IFC<8164THEN1010
1035 POKEA-1,SP
1040 RETURN
1499 REM*CRASH*
1500 POKE36879,42:POKEA,42:POKEA+22,35:POKEA-22,35
1510 POKE36877,220:FORL=15TO0STEP-1:POKE36878,L:FORM=1TO300:NEXTM,L:POKE 5877,0:
POKE36878,0
1515 POKE36879,27:PRINT"■
1520 PRINT"  NOTHER GAME(Y/N)?"
1530 GETB$:IFB$=""THEN1530
1540 IFB$="Y"THEN5
1550 END
2000 REM*INTRODUCTION*
2005 POKE36879,11:PRINT"J■■■■■■■BOMBER"
2010 PRINT"■■■■■■■*****":PRINT
2020 PRINT"THE OBJECT OF THE":PRINT"GAME IS TO CLEAR A"
2030 PRINT"LANDING STRIP FOR YOUR":PRINT"PLANE BY BOMBING THE"
2040 PRINT"BUILDINGS,PRESSING":PRINT"KEY■F■RELEASES YOUR":PRINT"BOMBS."
2050 PRINT:PRINT"ENTER YOUR SKILL LEVEL":PRINT
2060 PRINT"IN THE RANGE 5(EASY)":PRINT"TO 20(SUICIDAL)"
2070 INPUTSK:IFSK<5ORSK>20THEN2060
2075 X=SK
2080 PRINT"HIT ANY KEY TO START."
2090 GETC$:IFC$=""THEN2090
2095 GOTO10
2499 REM*A/C LANDED*
2500 PRINT"■■■■CONGRATULATIONS":PRINT:PRINT"WANT TO TRY AGAIN(Y/N)"
2510 GETD$:IFD$=""THEN2510
2520 IFD$="Y"THEN5
2530 END
```

The real world

Michael Johnson,
London N16.

ZX-81

EVER SINCE I bought my ZX-81 and 16K RAM earlier this year I have been interested in discovering ways of using it to help me with the routine calculations and figure work associated with my job.

I have found that a number of routines and programs have proved to be very useful indeed: carry-outs, cash-flow projections and sales analyses are all much less of a chore than they used to be.

This routine may be of use to those who are interested in real world applications for the ZX-81. This routine allows you to enter any quantity of data as part of a single string.

The bits of data are separated by commas, following the convention of Data statements found in other Basic dialects. The machine uses the commas to identify the bits of data ready for subsequent operations.

The input as a string seems to me to have two advantages: there is no need to wait for the cursor to reappear before inputting the next piece of data, and secondly, the string assignment allows direct inputting of an expression such as *7 or /25 which can be applied to the original data. Of course this routine is only one building block in what can be developed into a customised "Intelligent Calculator" program. One suggestion which I would make is to convert the broken-up bits of string into a dimensioned array for later re-use.

I should point out that this use of concatenated strings in the handling of numerical data does present certain pitfalls for the unwary. The routine I have mentioned is in fact derived from a mini-routine which can be used to explore and experiment with strings and numbers:

```
10 INPUT A$
20 INPUT B$
30 PRINT A$,B$
40 PRINT VAL (A$+B$)
50 RUN
```

Note that 2 followed by +2 gives 4. A$ = "25", B$ = "/2" gives 12.5. A$ = "23+2", B$ = "-5" gives 20. Care needs to be taken with priorities and with bracketing. For example, A$ = "(4", B$ = "+4)/2" gives 4. As a point of interest, someone may care to ponder for a moment why A$ = "2+3", B$ = "3" results in 35 and A$ = "7+1", B$ = "4" results in 21.

```
10 REM INITIALISE DATA, M. JOHNSON
20 SCROLL
30 PRINT "INPUT DATA, SEPARATED BY
   COMMAS"
40 INPUT A$
50 SCROLL
60 PRINT A$
70 LET A$ = A$+",*"
80 LET B=1
90 LET C=1
100 SCROLL
110 PRINT "ENTER OPERATION AND
    EXPRESSION"
120 INPUT B$
130 CLS
140 PRINT AT 6,0;"DATA ";A$(TO LEN
    A$-2),, B$
150 PRINT
160 FOR N=1 TO LEN A$
170 IF A$(N) <> "," THEN GOTO 220
180 IF A$ (N) = "*" THEN GOTO 230
```

(continued on page 101)

(continued from page 99)

```
190 LET C=N
200 PRINT VAL (A$(B TO C-1)+B$)
210 LET B=C+1
220 NEXT N
230 GOTO 80
```

To conserve memory, delete lines 20,50, and 100, and change line 140 to Print B$.

The input for A$ needs to read for example "20,456,783,12.5,3". The input for B$ needs to be something like "*5" or "+200" or "/100*25".

Gripe cure

Julian Vincent, Reading, Berkshire.

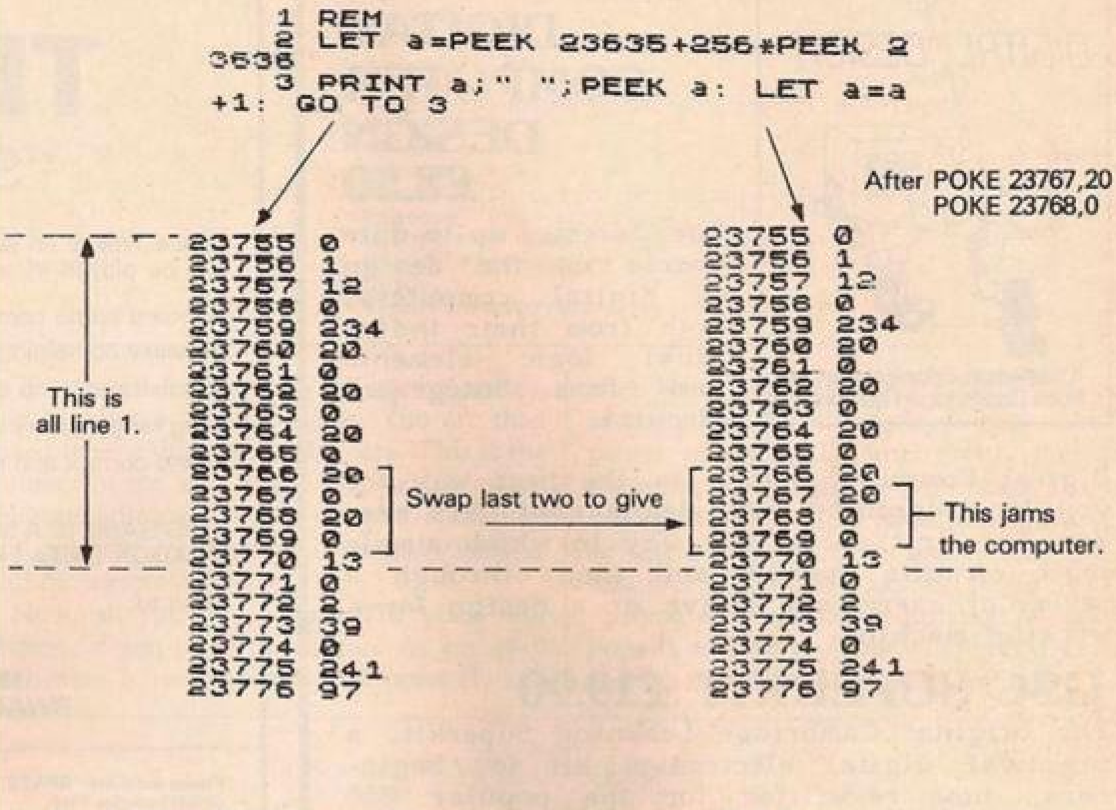
SPECTRUM

I HAVE JUST solved a problem which has been plaguing me on my Spectrum. It occurred after editing lines which ended in the inverted video mode. Occasionally I would edit such a line only to find that the Spectrum belched as if it were full and refused to list any more of the program. Also the cursor was very sluggish.

The answer seems to be due to the way Inv Video and True Video act. Inv Video puts 20, 1 into two memory locations in the line, although of course there is nothing on the screen to show this. If you press either key several times you fill up that program line two locations at a time.

If you happen to end an inverse video line with two presses of the True Video control, that is, 20,0,20,0 in RAM and make a hash of editing it later, you can end up with 20,0,0, at the end of the line, which the Spectrum does not like.

It is easily corrected but caused me some problems until I sorted it out.



If you POKE 23767,0, everything works. You must have 20,0,0.

The hawk

Roy Pincott, Mansfield.

ATOM

FLY AFTER the aliens, shoot them down and score 50 points. Try and beat the top score. Move left or right at the same time as you move up or down and fire.

Do not crash into the aliens or into the stratosphere. You have to land to be able to reload your laser guns. All the controls are explained in the program itself.

```
2IF O>610;O=0
3IF O<>0 G.10
5O=0
10G.1000
15DIM AA(10),Q(7)
20C=0;D=0;E=1;T=0;P=48
25M=110;L=100;S=£8000
30G.100
48!Q=£2A26221C;Q!4=£1C2232;R.
49!Q=£08081808;Q!4=£1C0808;R.
50!Q=£1C02221C;Q!4=£3E2020;R.
51!Q=£0C02221C;Q!4=£1C2202;R.
52!Q=£3E140C04;Q!4=£040404;R.
53!Q=£023C203E;Q!4=£1C2202;R.
54!Q=£3C20201C;Q!4=£1C2222;R.
55!Q=£0804023E;Q!4=£202010;R.
56!Q=£1C22221C;Q!4=£1C2222;R.
57!Q=£1E22221C;Q!4=£1C0202;R.
100CLEAR4
110A=£8D0F;?A=£DF
120F.U=£81E0 TO £81FF;?U=£FF;N.U
140F.X=1TO10
150R=A.R.%£15FF+£8200
160AA(X)=R
165IF ?AA(X)=£18;X=X-1;IF X<1;X=1
170?AA(X)=£18
180N.X
300F.B=1TO5;?£B000=?£B000 &£F0 +B
310B?£7F=?£B001 &B;N.B
400IF ?£80=0;L=L-12;IF L<0;L=0
410GOS.o
420F.Z=1TO10
500IF L<1;G.520
510IF ?£80=0;F.W=1TO6;?£B002=?£B002:4;N.W;GOS.e
520IF ?£81=0 GOS.d
530IF ?£82=0 GOS.c
540IF ?£83=0 E=1;?A=£DF;GOS.r
550IF ?£84=0 E=2;?A=£FB;GOS.r
630N=A.R.%10+1
632IF E=1;G.640
634IF E=2;G.645
636G.650
640IF ?AA(N)=£18;?AA(N)=£00;AA(N)=AA(N)+£1;GOS.i;?AA(N)=£18
642G.650
645IF ?AA(N)=£18;?AA(N)=£00;AA(N)=AA(N)-£1;GOS.i;?AA(N)=£18
650N.Z
660M=M-1;GOS.p
670IF M=0;G.2000
999G.300
1000CLEAR0
1010P.$12'
1020P."              the hawk"''"         BY roy pincott"''
1100P."C FLY LEFT          B FLY RIGHT"''
1110P."E CLIMB             D DESCEND"''"          F FIRE"''
1120P."       LAND TO RELOAD"''
1130IF O>-1;IF O<610;P."TOP SCORE "O''
1200LINK £FFE3
1999G.15
2000CLEAR0;P.$12'''
2020IF M>O;O=M
2030P."TOP SCORE "O''
2050P."SCORE  "M''''''
2199E.
7100bX=A.R.%£FF
7120?A=£00;A=A+£20;?A=X
7130IF A>=£97FF;G.2000
7140G.b
7200cIF ?A=£DF;?A=£00;A=A+£20
7205IF ?A=£FB;?A=£00;A=A+£20
7207IF A>£97FF;A=A-£20;L=L+10;GOS.k
7208IF L>600;L=600
7210GOS.8000
7215R.
7300dIF ?A=£DF;?A=£00;A=A-£20
7305IF ?A=£FB;?A=£00;A=A-£20
7307IF A<£8200;A=A+£20;G.b
7310GOS.8000
7315R.
7400eIF E=2;B=A;F.X=1TO6;B=B+£1;GOS.f;?B=£FF;N.X
7430IF E=2;B=B-6 ;F.X=1TO6 ;B=B+£1;?B=£00;N.X
7450IF E=1;B=A;F.X=1TO6;B=B-£1;GOS.f;?B=£FF;N.X
7460IF E=1;B=B+6 ;F.X=1TO6 ;B=B-£1;?B=£00;N.X
7499R.
7500fIF ?B=£18;F.W=1TO 90;?£B002=?£B002&R.:4;N.W;M=M+50;GOS.g
7505IF D=10;G.2000
7510R.
7800iIF ?AA(N)=£18;G.7802
7801G.7805
7802IF ?A=£DF;AA(N)=AA(N)-1
7803IF ?A=£FB;AA(N)=AA(N)+1
7805IF ?AA(N)=£DF;G.b
7810IF ?AA(N)=£FB;G.b
7820IF AA(N)<£8200;AA(N)=£97FF
```

(continued on page 103)

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ZX81 16K RAMPACK

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PLANET SOFTWARE
10 Norton Drive, Eaton, Norwich, NR4 6JD

(continued from page 101)

```
7830IF AA(N)>£97FF;AA(N)=£8200
7890R.
8000IF E=2 G.8050
8005IF ?A=£00;?A=£DF
8010IF ?A=£18;?A=£00;G.b
8040R.
8050IF ?A=£00;?A=£FB
8060IF ?A=£18;?A=£00;G.b
8080R.
8100rIF T<-8;G.8150
8120IF ?A=£DF;?A=£00;A=A-1;GOS.s;?A=£DF;T=T-1
8150IF T>8;G.8250
8220IF ?A=£FB;?A=£00;A=A+1;GOS.s;?A=£FB;T=T+1
8250R.
8300sIF ?A=£18;G.b
8310R.
9000kJ=92;K=J
9002IF L<100;J=93;K=J
9005F=L
9020GOS.q
9070R.
9100gJ=64;K=J;D=D+1
9105F=M
9120GOS.q
9170R.
9400oJ=92;K=J
9405F=L
9410IF F<100;J=92;GOS.CH"0";GOS.1;J=K+1;K=J
9420GOS.q
9470R.
9500pJ=64;K=J
9505F=M
9510IF F<100;J=64;GOS.CH"0";GOS.1;J=K+1;K=J
9520GOS.q
9570R.
9620qSTR F,P
9630IF F<10 GOS.CH"0";GOS.1;J=K+1;K=J
9640GOS.(P?0);GOS.1;J=K+1;K=J
9650IF F>9 GOS.(P?1);GOS.1;J=K+1;K=J
9660IF F>99 GOS.(P?2);GOS.1;J=K+1;K=J
9670R.
9700lF.V=0TO7;S?J=Q?V;J=J+32;N.V;R.
```

Vic synth

Kevin Boyd,
Dreghorn,
Ayrshire.

VIC-20

FOR THE UNEXPANDED Vic-20, this program will convert your keyboard into a synthesiser. When the program is run it asks which voice you require from 1-4.

The first three are the Vic's normal voices, and number 4 is white noise. You are then asked for the duration of the note. This is the number of the step in the loop which makes the sound die away — so if you pick 1, the note will die away very quickly; if you pick 0.001, it will die away slowly.

Now, all you do is play. The voice will change, if you press the button. As you play each note is remembered. Just press f1, and after being asked to select a voice, you will hear your composition played back with all pauses removed. To insert rests, press the space bar when entering your tune. You can only have a tune of 99 notes, though this can be altered by changing line 1 and 135 to whatever number of notes you require.

If you wish to reset the duration of the note press 0, and the program will erase your tune and ask for voice and duration of note.

```
1 CLR:DIMP(100)
2 POKE36879,8
5 PRINT"J"
6 PRINT"■"
10 PRINT"VIC-20 SYNTHESIZER"
20 INPUT"WHICH VOICE";S
30 IFS<1ORS>4THEN20
40 S=INT(S)+36873
50 POKE36878,15
51 DIMA(100)
55 PRINT"■DURATION OF NOTE          1-0.001
56 INPUTSP
57 IFSP>1ORSP<0.001THEN56
60 READN:IFN=0THEN80
70 READA(N)
75 GOTO60
80 GETA$:IFA$=""THEN80
81 IFA$="A"THENRUN
85 IFA$="■"THEN1000
86 IFA$="1"ORA$="2"ORA$="3"ORA$="4"THENGOSUB180:GOTO80
90 N=ASC(A$)
96 IFA$="0"THENN=79
97 IFA$="N"THENN=78
120 FORT= TO10:NEXT
130 POKES,A(N):PRINT"J":POKE36879,A(N)
131 FORB=15TO0STEP-SP:POKE36878,B:NEXT:POKES,0:POKE36878,15
135 X=X+1:P(X)=A(N):IFX=99THENRUN
140 GOTO80
180 POKES,0:K=VAL(A$):S=K+36873:RETURN
200 DATA81,135,87,143,69,147,82,151,84,159,:3,163,85,167,73,175
210 DATA79, 79,80,183,64,187,42,191,92,195,65,199,83,201,68,203
220 DATA78,207,71,209,72,212,74,215,75,217,76,219,58,221
230 DATA59,223,61,225,13,227,90,228,88,229,67,231,86,232,66,233
240 DATA79,235,77,236,44,237,46,238,47,239,17,240,29,24 ,0
1000 PRINT"JMEMORY REPLAY"
1001 POKE36F'9,8
101  INPUT"WHICH VOICE ";R
1020 IFR<1ORR>4THEN1010
1021 POKE36878,15
1030 FORF=1TOX
1031 FORB=15TO0STEP-SP:POKE36878,B:NEXT:POKE36873+R,0:POKE36878,15
1040 POKE36873+R,P(F):PRINT"J":POKE36879,P(F)
1050 NEXTF
1051 FORB=15TO0STEP-SP:POKE36878,B: EXT:POKE36873+R,0:POKE36878,15
1 52 POKE36879,8
1060 PRINT"WHAT NEXT:"
1070 PRINT"1:PLAY TUNE AGAIN?"
1080 PRINT"2:RETURN TO KEYBOARD?"
1090 GETF$:IFF$=""THEN1090
1100 IFF$="1"THEN1000
1110 IFF$="2"THEN1
1111 GOTO1090
```

3-D bar chart

J Meech,
Stockport,
Cheshire.

BBC

THIS PROGRAM is for Model B users — for conversion to Model A change lines.'

10 MODE 7
115 MODE 5

It is a variation on a bar graph, but each column is viewed in perspective, giving a three-dimensional appearance.

The user types in data which the program draws as a pie chart, giving the data as fractions of 360. The percentage is also given, along with the corresponding colour.

```
>LIST
   10 REM **** J MEECH ****
   20 MODE1
   30 PRINT''TAB(10)"3-D BAR CHART"''"PLEASE TYPE IN THE NUMBER OF"'"ENTERIES (2
      -10)"
   40 INPUT S:IF S<2 OR S>10 THEN 30
   50 DIM A(S)
   60 X=100
   70 PRINT'"PLEASE TYPE ENTRIES FOLLOWED"'"BY RETURN"
   80 FOR I=1 TO S
   90 INPUT Y
  100 A(I)=Y
  110 NEXTI
  120 PRINT "THE ENTRIES WILL BE AUTOMATICALY"'"SCALED - THE MAXIMUM & AVERAGE D
      ISPLAYED"'
```

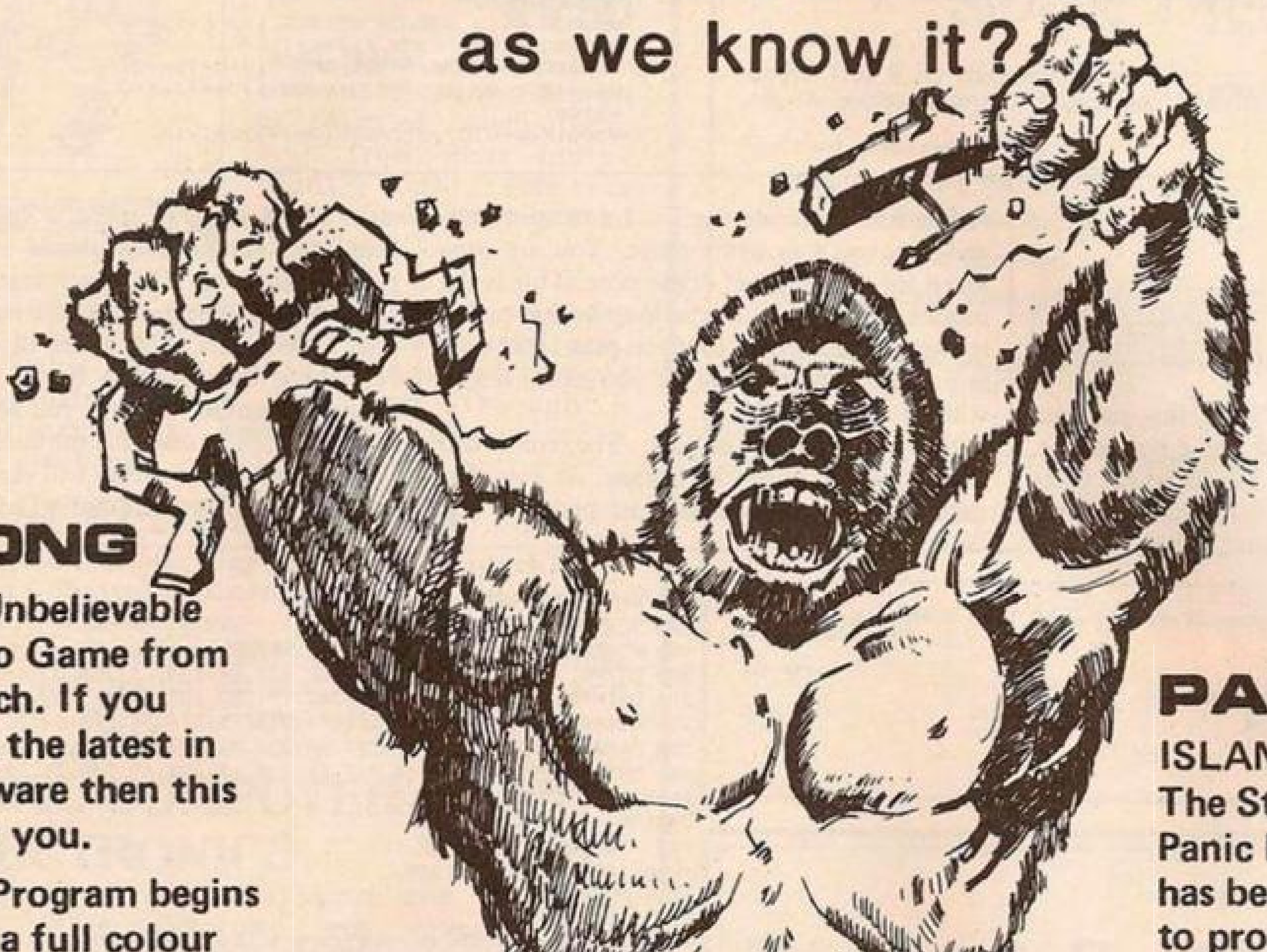
(continued on page 105)

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(continued from page 103)

```
130 PRINT "PRESS RETURN TO START":INPUT Q$:CLS
140 PROCSCALE
150 PRINT ''"AVERAGE ";J'"MAXIMUM ";R
160 MOVE 100,0:DRAW 100+(S*100),0
170 FOR I=1 TO S
180 Y=A(I)
190 PROCDRAW(Y)
200 NEXT I
210 END
220 DEFPROCDRAW(Y)
230 REM **** DRAW TOP ****
240 GCOL 0,1
250 MOVE X,Y:DRAW X+100,Y
260 PLOT85,X+130,Y+100
270 DRAW X+30,Y+100:DRAW X,Y
280 PLOT 85,X+130,Y+100
290 REM ****DRAW LINES TO BASE ****
300 GCOL 0,2
310 MOVE X,Y:DRAW X,0
320 MOVE X+100,Y:DRAW X+100,0
330 MOVE X+130,Y+100:DRAWX+130,0
340 MOVE X,Y:MOVE X+100,Y:PLOT 85,X,0
350 MOVE X+100,0:PLOT 85,X+100,Y
360 X=X+100
370 ENDPROC
380 DEF PROCSCALE
390 J=0
400 FOR I=1 TO S
410 J=J+A(I)
420 NEXT I
430 J=J/S
440 FOR I=2 TO S
450 IF A(I)>A(I-1)THEN R=A(I)
460 NEXT I
470 K=-1
480 IF R<400 THEN K=2
490 IF R<200 THEN K=4
500 IF R<100 THEN K=9
510 IF R>900 THEN K=.5
520 IF K=-1 THEN ENDPROC
530 FOR I=1 TO S
540 A(I)=A(I)*K:NEXTI
550 ENDPROC
```

Visual recall

A J Hynd,
Hayling Island,
Hampshire.

BBC

THIS PROGRAM allows the contents of memory to be displayed and examined. I have used this on my BBC Model A to recover programs, which have become corrupted when saved or loaded, by examining the line numbers and line lengths in the stored Basic program. Errors can be calculated and then corrected by Poking new data into the appropriate addresses.

The start addresses can be entered in either decimal or hexadecimal form, but all displayed values are in hex. Lines 20 and 30 set page mode and print format, and line 130 resets these on Escape.

The input procedure first checks to see if the entry is a hex number otherwise it checks for valid decimal inputs.

I found the EVal function very useful for converting the string input to a hex number. The Shift key is used to give further pages of display, and the Escape key to exit.

The program has to be entered so as not to overwrite the memory contents you wish to examine. First Load the program to be examined but do not Run, then enter

PAGE = TOP +&100

Then Load this program which can be Run without affecting your first program; to reset enter

PAGE = &E00

which is where Basic programs are normally stored for conventional purposes.

```
  2 REM MEMORY CONTENT
S MONITOR
 10 ON ERROR GOTO 130
 20 MODE 7:VDU14
 30 @%= &A04
 40 PROCinput
 50 REPEAT
 60 PRINT~addres;
 70 FOR J = 1 TO 8
 80 PRINT,~?address;
 90 address=address+1
100 NEXT
110 PRINT
120 UNTIL FALSE
130 VDU!%*@%=&A0A:END
140 DEFPROCinput
150 *FX15,0
160 CLS:INPUT"START AD
DRESS "A$
170 IF LEFT$(A$,1)="&"
THEN address=EVAL(A$):EN
DPROC
180 FOR K=1 TO LEN(A$)
190 IF ASC(MID$(A$,K,1
))<48 OR ASC(MID$(A$,K,1
))>57 THEN K=LEN(A$):VDU
7:GOTO 160
200 NEXT
210 address=VAL(a$)
220 ENDPROC
```

New quirk

Deryck Brown,
Kilmarnock,
Ayrshire.

ZX-81

I DO NOT mean one of the frequently publicised ZX-81 quirks but a brand new one. Believe it or not the ZX-81 accepts the following commands quite happily:

```
10 LOAD "ANYNAME" (THEN) REM
  COMMENT
or 10 SAVE "ANYNAME" (THEN) REM
  COMMENT
```

The Then is in brackets as it can be deleted if wished after typing Rem or left in—it makes no difference. Possibly there are other statements which behave like this but I have not found any.

This additional Rem not only saves bytes but does not, of course, have to refer to the Save or Load instruction. This would be particularly useful in adventure games where the program may be saved from inside so that it restarts automatically or used when chaining programs. String variables can also replace the program name:

```
10  SAVE A$ (THEN) REM COMMENT
```

Bit bandit

S P Elliot,
Middlesbrough,
Cleveland.

ATOM

A SIMPLE "one-armed bandit", this program for the Acorn Atom requires 32K RAM. Floating point is not required. Instructions are included in the program. Note that, in the printout, £ means #.

```
 1 REM bandit BY S.P.ELLIOT:  31.1.82
 2 GOS.i;CLEAR0;P.$30;@=0;K=0
 3 P."$$$ = 1000"'"$$- = 100"'"xx- = 50"'"&&- = 50"'
 4 P."££- = 50"'"$-- = 40"'"x-- = 20"'"&-- = 20"'
 5 P."£-- = 20"''"SCORE"'
 6 GOS.a
 7 G.v
10 P.K"     "
12 A=£A3;B=£A6;C=£A9
```

(continued on next page)

(continued from previous page)

```
15 D=0;E=A.R.%13+15;F=E+A.R.%9+5
16 G=F+A.R.%9+3;H=1;J=£B002;O=0
30 IF D<E GOS.b
40 IF D<F GOS.c
50 IF D<G GOS.d
51 ?J=?J:4
52 D=D+1
57 IF D>58 G.e
60 G.30
200aMOVE21,5;DRAW21,32;DRAW36,32;DRAW36,5;MOVE36,20
210 DRAW39,20;DRAW39,30
220 FORI=0TO6;I?£814B=£FF;N.
230 FORI=0TO6;I?£816B=£66;N.
240 FORI=0TO6;I?£818B=£D9;N.
250 FORI=0TO6;I?£81AB=£7F;N.
255 ?£80EB=£3E;?£80F1=£3C
260 ?£80CC=£82;?£80CE=£81;?£80D0=£8E;?£80EC=£84;?£80EE=£89
265 ?£80F0=£94;?£810C=£A4;?£810E=£A4;?£8110=£A4;?£E1=0
270 R.
300bWAIT;?£80CC=A;GOS.z;WAIT;?£80EC=A;GOS.z;WAIT;?£810C=A
302 A=A-1
305 IF A=£A2 A=£AB
306 A=A-1;IF A=£A2 A=£AB
307 A=A-1;IF A=£A2 A=£AB
310 GOS.w;R.
350c WAIT;?£80CE=B;GOS.y;WAIT;?£80EE=B;GOS.y;WAIT;?£810E=B
351 B=B+1
353 IF B=£AC B=£A3
355 B=B+1;IF B=£AC B=£A3
357 B=B+1;IF B=£AC B=£A3
360 GOS.w;R.
400d WAIT;?£80D0=C;GOS.x;WAIT;?£80F0=C;GOS.x;WAIT;?£8110=C
402 C=C-1
403 IF C=£A2 C=£AB
405 C=C-1;IF C=£A2 C=£AB
407 C=C-1;IF C=£A2 C=£AB
410 GOS.w;R.
450w IF D>F H=14;G.455
451 IF D>E H=9;G.455
455 F.I=1 TO(D*H);N.;R.
500x C=C+1;IF C=£AC C=£A3
505 R.
520y B=B-1;IF B=£A2 B=£AB
525 R.
550z A=A+1;IF A=£AC A=£A3
555 R.
600e IF?£80EC=£A4 AND?£80EE=£A4 AND?£80F0=£A4 GOS.f;G.v
605 IF?£80EC=£A4 AND ?£80EE=£A4 GOS.g;G.v
610 IF?£80EC=£AA AND?£80EE=£AA GOS.h;G.v
615 IF?£80EC=£A6 AND?£80EE=£A6 GOS.h;G.v
620 IF?£80EC=£A3 AND?£80EE=£A3 GOS.h;G.v
625 IF?£80EC=£A4 GOS.j;G.v
630 IF?£80EC=£AA GOS.k;G.v
635 IF?£80EC=£A6 GOS.k;G.v
640 IF?£80EC=£A3 GOS.k;G.v
645 G.v
750f O=100;GOS.l;K=K+1000;R.
800g O=10;GOS.l;K=K+100;R.
820h O=5;GOS.l;K=K+50;R.
840j O=4;GOS.l;K=K+40;R.
850k O=2;GOS.l;K=K+20;R.
900v P.$13,K"     ";LINK£FFE3;K=K-10;P.$13;G.10
950l FORI=1TO30;WAIT;N.
955 F.I=1TO O;WAIT;WAIT;WAIT;WAIT;F.L=1TO25;?J=?J:4;N.L;N.I;R.
1000i P.$12"  instructions for bandit"'''
1005 P."PRESS ANY KEY TO RUN BANDIT,"''
1007 P."SCORE IS REDUCED BY 10"
1010 P." EACH GO."''
1015 P."WINNINGS ARE ADDED TO SCORE."''
1020 P."PRESS ESC.WHEN BANKRUPT!"''''''
1025 P."          press any key"'
1050 LI.£FFE3;R.
```

Vic stick

Andrew Tuck,
Westcliff on Sea,
Essex.

VIC-20

THIS SHORT PROGRAM allows the user to draw in high resolution using a joystick on the unexpanded Commodore Vic-20 machine.

The first line sets the screen size to 16 by 10 and changes the Screen and Border combination to black.

Lines 1 to 4 set up the screen and draw a box around it to show the user the limits of the screen.

Line 10, which must be entered using Shifted keywords, converts the joystick port to X and Y values.

Line 20 allows the point to move and not draw by pressing the fire button. Lines 50 and 60 plot and calculate the point.

There are approximately 2,500 points to plot, quite adequate for most drawings although not true high resolution.

```
0 POKE36879,8:POKE36867,21:POKE36864,17:POKE36865,45:POKE36866,144:POKE36869,253
1 PRINT"♥":FORA=1TO16:FORN=1TO10:POKE7663+16*N+A,N+10*A-11:NEXTN,A
2 FORA=5120TO7679:POKEA,0:NEXT:POKE37154,127:X=64:Y=80
3 FORA=5120TO7679STEP160:POKEA,255:POKEA+159,255:NEXT
4 FORA=5121TO5278:POKEA,128:POKEA+2400,1:NEXT
10 A=PEEK(37137):X=X+((AAND16)=0):Y=Y+((AAND4)=0):Y=Y-((AAND8)=0):X=X-((PEEK(371
52)AND128)=0)
20 F=-((AAND32)=0):IFF=1THEN60
50 Y1=Y+5120+160*INT(X/8):POKEY1,PEEK(Y1)OR2↑(7-XAND7):GOTO10
60 Y1=Y+5120+160*INT(X/8):POKEY1,PEEK(Y1)ANDNOT2↑(7-XAND7):GOTO10
```

List self-starters

Gino Gracin,
Rijeka,
Yugoslavia.

ZX-81

PROGRAMS THAT start automatically after Loading, and that are fully in machine code, like ZX Chess, can not be easily Listed. Here is a program which enables this.

Before writing in or loading this program
POKE 16389,127/NEW
must be done. After inputting program name, the ZX-81 starts looking for the program.

When the program is Loaded, C/170 will appear, and the program is ready for further manipulation.

```
  1 FAST
 10 LET A=32513
 20 POKE A,17
 30 POKE A+1,8
 40 POKE A+2,127
 50 POKE A+3,205
 60 POKE A+4,67
 70 POKE A+5,3
 80 POKE A+6,201
100 PRINT "PROGRAM NAME?"
110 INPUT N$
120 IF LEN N$=1 THEN GOTO 160
130 FOR I=1 TO LEN N$-1
140 POKE 32519+I,CODE N$(I)
150 NEXT I
160 POKE 32519+LEN N$,CODE N$(L
EN N$)+128
170 RAND USR A
```

Tape salvage

Paul Mudditt,
Jarrow,
Tyne and Wear.

BBC

IN ANSWER to many a BBC Micro owner's prayers I offer my own version of a tape salvage program. As many BBC owners will know the 0.1 operating system has two bugs in the cassette filing system. This program attempts to salvage a program which has had Block 0 corrupted due to one of these bugs. According to Acorn this bug would corrupt on average Block 0 of one program in 16.

There is now a well-publicised machine-code fix for both of these bugs, but these have

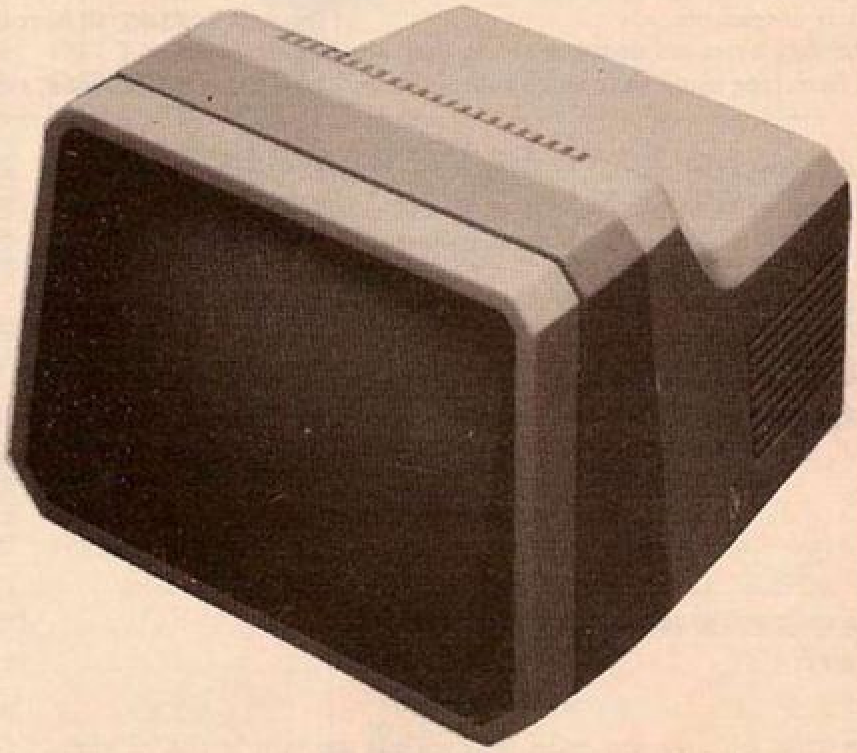
(continued on page 108)

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(continued from page 106)
arrived too late for many users.

My program will attempt to read in as many Basic lines as possible starting from any block number until the end of the program is reached. Errors in the format of the data coming from the tape will simply mean a missing line of Basic which the user will have to re-enter but at least you will not have to retype 10K of program lost because the first block is unreadable.

The data bytes are de-tokenised as they are read from tape using the crunch subroutine in the Basic ROM converting single bytes to Basic keywords so that a check can be made of the lines coming in. However I am de-tokenising all but the line number and the line length and consequently characters within quotes and Goto/Gosub statements will appear to be incorrect when in fact they are intact.

I suggest that the machine-code fixes are chained in before loading this program to ensure when you resave your salvaged program you do not have to repeat this process unnecessarily.

To use the program, type Run and position your cassette to just before the program to be salvaged.

Then, the program will list to the screen as it is found on tape and is stored above this program in memory. When the end of the program is reached or Escape is pressed the program will reset page to the start of the salvaged program. Typing List will display the salvaged program which can be saved in the usual way.

If you are not satisfied with the salvaged program, type Break then Old <CR> and repeat the process.

```
10 ON ERROR PRINT'':REPORT:PRINT" error at line ";ERL:GOTO 310
20 CRUNCH=&B53A:REM THIS SUBROUTINE DETOKENISES BASIC
                OR PRINTS THE ASCII OF A%
30 REM SELECT SHORT MESSAGES
40 *OPT 1,2
50 REM MAKE COMPUTER IGNORE ALL TAPE ERRORS
60 *OPT 2,0
70 page=(TOP DIV 256)*256+256:REM SELECT NEW PAGE VALUE TO LOAD
                              PROGRAM INTO.
80 index=0:REM page OFFSET POINTER
90 X=OPENIN(""):REM LOAD ANYTHING ON THE TAPE
100 REM SELECT NO TAPE MESSAGES FROM NOW ON
110 *OPT 1,0
120
130 REPEAT A%=BGET#X:UNTIL A%=&0D:PRINT:REM WAIT HERE UNTIL WE FIND THE START
   OF A NEWLINE OF BASIC TEXT.
140 PROCPoke(A%):REM POKE IN &0D '<CR> CHARACTER' TO START PROGRAM STORAGE
150
160 REPEAT:Lastnewline=index
170   LnH%=BGET#X:PROCPoke(LnH%):REM 1st BYTE IS HIGH PART OF LINE NUMBER
180   LnL%=BGET#X:PROCPoke(LnL%):REM 2nd BYTE IS LOW PART OF LINE NUMBER
190   L%=BGET#X:PROCPoke(L%):REM LENGTH OF BASIC LINE
200   PRINT TAB(20);LnH%*256+LnL%;:REM DISPLAY LINE NUMBER
210
220   REM THIS PART LISTS BASIC LINE TO SCREEN AND STORES IT IN MEMORY
230
240   REPEAT
250     A%=BGET#X:PROCPoke(A%)
260     IF A%<32 OR A%=127 THEN PRINT" "; ELSE CALL CRUNCH
270     UNTIL A%=&0D:PRINT
280
290   UNTIL EOF#X
300
310 CLOSE#X
320 PRINT
330 index=Lastnewline:PROCPoke(&FF):REM FINAL BYTE IN ALL BASIC PROGRAMS 'MUST
 ' BE &FF SO INSERT THIS FOLLOWING LAST RECORDED <CR>
340 REM RESET DEFAULT MESSAGES
350 *OPT
360 PAGE=page:REM SET PAGE TO START OF SALVAGED PROGRAM
370 END
380
390 DEF PROCPoke(B%)
400 page?index=B%
410 index=index+1
420 ENDPROC
```

Error fix

C Cytera,
Mangotsfield,
Avon.

ATOM

HERE IS A way of removing an irritating quirk of the Acorn Atom. I am referring to the error message produced whenever a control code is used. The Escape key can, of course, be pressed after any control code is executed, but this should not be necessary.

The program works by intercepting OSRDCH. Routine LL0 saves the previous address of OSRDCH in location #90 and #91. It then installs the address of routine LL2 in #20A and #20B. This means that LL2 is called whenever the Atom requires an input from the keybord. LL2 firstly calls the usual routine to obtain the ASCII code of the key pressed. If this represents a character, or one of the control codes representing Escape, Cancel and Carriage Return, an exit occurs with the code retained in the accumulator.

This is necessary because other sections of the operating system must take action on these codes. If it is any other control code, the program loops back, executes it by calling OSWRCH, and waits for another key to be pressed.

The error remover resides in an otherwise unused area of memory: from #28D1 to #28FF. Once assembled it is executed by

LINK #28D

The machine code, which should be *Saved with the mnemonics discarded, can be reloaded and executed with *Run. The Plot commands in graphics mode 0 can be made to operate in grey instead of white simply by filling the screen with character #C0 after a Clear 0 command.

FOR S = #8000 TO #81FF STEP 4;!S = #COCOCOCO;NEXT S

Black-on-grey plotting can be achieved by

FOR S = #8000 TO #81FF STEP 4;!S = -1;NEXT S

The usual plot-in-black commands, for example, Plot 15, should be used there.

```
   10 DIM LL4
   20 FORZ=0TO4;LLZ=-1;
NEXT
   30 PRINT$21
   40 FORN=1 TO 2
   50 P=#28D1
   60 [
   70 :LL0 \ INIT.
   80 LDA #20A
   90 STA #90
  100 LDA #20B
  110 STA #91
  120 LDA @LL2&#FF
  130 STA #20A
  140 LDA @(LL2/256)&#FF
  150 STA #20B
  160 RTS
  170:LL1 JSR #FFF4 EXEC
UTE IT
  180:LL2 JSR LL4 GET KE
Y
  190 CMP @#1B ESC
  200 BEQ LL3
  210 CMP @#18 CAN
  220 BEQ LL3
  230 CMP @#D
  240 BEQ LL3
  250 CMP @#20
  260 BCC LL1
  270:LL3 RTS
  280:LL4 JMP (#90)
  290]
  300 NEXTN
  310 PRINT$6
  320 ENDPROC
```

Music notation

Ashley Robinson,
Monks Risborough,
Buckinghamshire.

ZX-81

FOR THOSE who have a limited 1K ZX-81 here is a little program which helps you to learn notes in music. It does not play the notes, but displays them on a treble stave.

When Run it shows a treble stave with a random blob or note somewhere on it. You have to press the correct note on the keyboard. It will then tell you whether you are right or wrong and if you press another key it will display another note.

It works by taking a random number and Printing At that number on the Y co-ordinate, a graphic square. It finds the answer by taking the code of that number, adding 34, and finding the CHR$, which should be a letter from A to G.

For those with 16K RAM packs you could make it play the note and display it.

```
  1 LET A=7
  8 PRINT
  9 PRINT
 10 FOR B=1 TO 5
 20 FOR N=0 TO 10
 30 PRINT "-";
 40 NEXT N
 45 PRINT
 46 PRINT
 50 NEXT B
 60 PRINT AT 0,0;" ████"
 70 PRINT "  █ █"
 80 PRINT "-─█-█"
 90 PRINT "  █ █"
100 PRINT "-─█-█"
110 PRINT "  ██"
120 PRINT "-─██"
130 PRINT "████"
140 PRINT "██-█"
150 PRINT "████"
160 PRINT "-█"
170 PRINT " █"
180 PRINT "██"
190 PRINT "██"
200 LET B=INT (RND*11)+1
210 PRINT AT B,A;"█"
215 IF B>=8 THEN LET B=B-7
220 LET B=(11-B)+34
230 PRINT AT 15,10;"YOUR GUESS?"
240 INPUT A$
250 IF CODE A$<>B THEN PRINT AT
15,10;"    WRONG    "
260 IF CODE A$=B THEN PRINT AT
15,10;"    RIGHT    "
270 PAUSE 4E4
275 CLS
280 RUN
```

Long line

Andrew Houston,
Manchester.

ATOM

THIS PROGRAM will allow Acorn Atom users to edit lines up to 160 characters long — five lines on the Atom's screen. Copy, Delete, Repeat can be used as usual.

When the program is Run, or whenever Link Q is entered — for example, after pressing Break — the prompt will look like this:

#>

indicating that all is well.

The machine code can be assembled at any desired address by altering Q in the first line. By forgoing the cancel facility, Control-X, and omitting lines 150 and 160, the code will even fit into the free space at #21C.

The program works by tricking the Atom's input routine, located at #CD0F, into believing that there is always just one more space available in the input buffer. If anyone should want to experiment with even longer lines, try changing line 130.

```
 10 Q=#2800
 20 DIM EE(3)
 30 FOR J=0 TO 3; EE(J)=Q; NEXT
 40 FOR K=1 TO 2
 50 P=Q
 60 [
 70 :EEO LDA @EE1&#FF; STA #20A
 80      LDA @EE1/256; STA #20B
 90      LDA @CH"#"
100      JMP (#208)
110 :EE1 JSR #FE94
120      CPY @63 ;BCC EE3
130      CPY @161;BCS EE3
140      CMP @127;BEQ EE3
150      CMP @24 ;BNE EE2
160      LDY @#FF;STY #52
170 :EE2 INC #52
180 :EE3 RTS
190 ]
200 NEXT K
210 LINK Q
220 END
```

Quick Peek

Alan Potter,
Glasgow.

ZX-81

IN MANY BASIC 1K games there is a line similar to:

LET A=PEEK(PEEK 6398+256*PEEK 16399)

This line tests to see if the next position in the display file to be Printed has anything in it, and, if so, what it is.

(PEEK 16398+256*PEEK 16399)

gives the address of the next position to be Printed, and this line Peeks into that address to see what is there.

This is a useful line, but time-consuming and heavy on memory. I have written a machine-code routine which duplicates this function, and is faster while using less memory, which, as any 1K user knows is a great help. This routine is:

Decimal	Hex	Mnemonic
42	2A	ld hl, (NN)
14,64	0E,40	16398
78	4E	ld c,(hl)
6,0	06,00	ld b,0
201	C9	ret

When this routine is called by a USR function, on return it will give the equivalent of the earlier Peek. To enter the routine, first of all write a Rem statement with seven characters. Then enter, as direct commands:

```
POKE 16514,42
POKE 16515,14
POKE 16516,64
POKE 16517,78
POKE 16518,6
POKE 16518,6
POKE 16519,0
POKE 16520,201
```

This will cause the Rem line to change, and the routine will be directly addressable using USR 16514. For those experienced in machine code, the routine may be stored anywhere since it contains no jumps.

I have written a short program to demonstrate this routine:

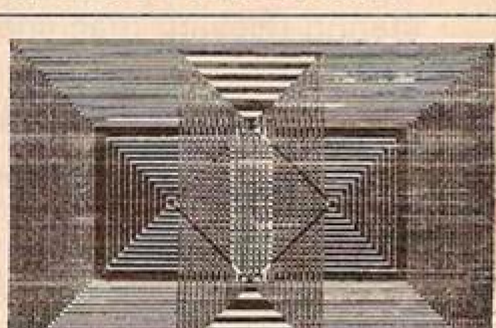
```
  1 REM (machinecode)
 10 LET P=9
 20 LET S=PI-PI
 30 SCROLL
 40 PRINT AT 12,P;
 50 LET U=USR 16514
 60 IF U<>0 AND U<>118 THEN GOTO
    VAL "200"
 70 PRINT AT 12,P;"V"
 80 LET P=P+(INKEY$="P" AND
    P<25)-(INKEY$="O" AND P>0)
 90 PRINT AT 21, (RND*25)+1;"*"
100 LET S=S+1
110 GOTO 30
200 PRINT "SCORE:";S
```

Strange patterns

James Southgate,
Colchester,
Essex.

SPECTRUM

THIS SHORT program makes good use of colour high-resolution graphics on the Spectrum. When the program is run a pattern is drawn on the screen. This pattern continuously changes in shape and colour. ■



```
 10 LET y=INT (RND*70)+100: LET
x=INT (RND*50): LET z=INT (RND*
3)-4
 20 FOR r=y TO x STEP z
 30 PLOT r,r: DRAW 0,175-2*r
 40 DRAW 255-2*r,0
 50 DRAW 0,-175+2*r
 60 DRAW -255+2*r,0
 70 INK RND*6
 80 OVER 1
 90 NEXT r
100 GO TO 10
```

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COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in December. The name of the winner, the solution, and a competition report will be published in the February, 1983 issue of *Your Computer.*

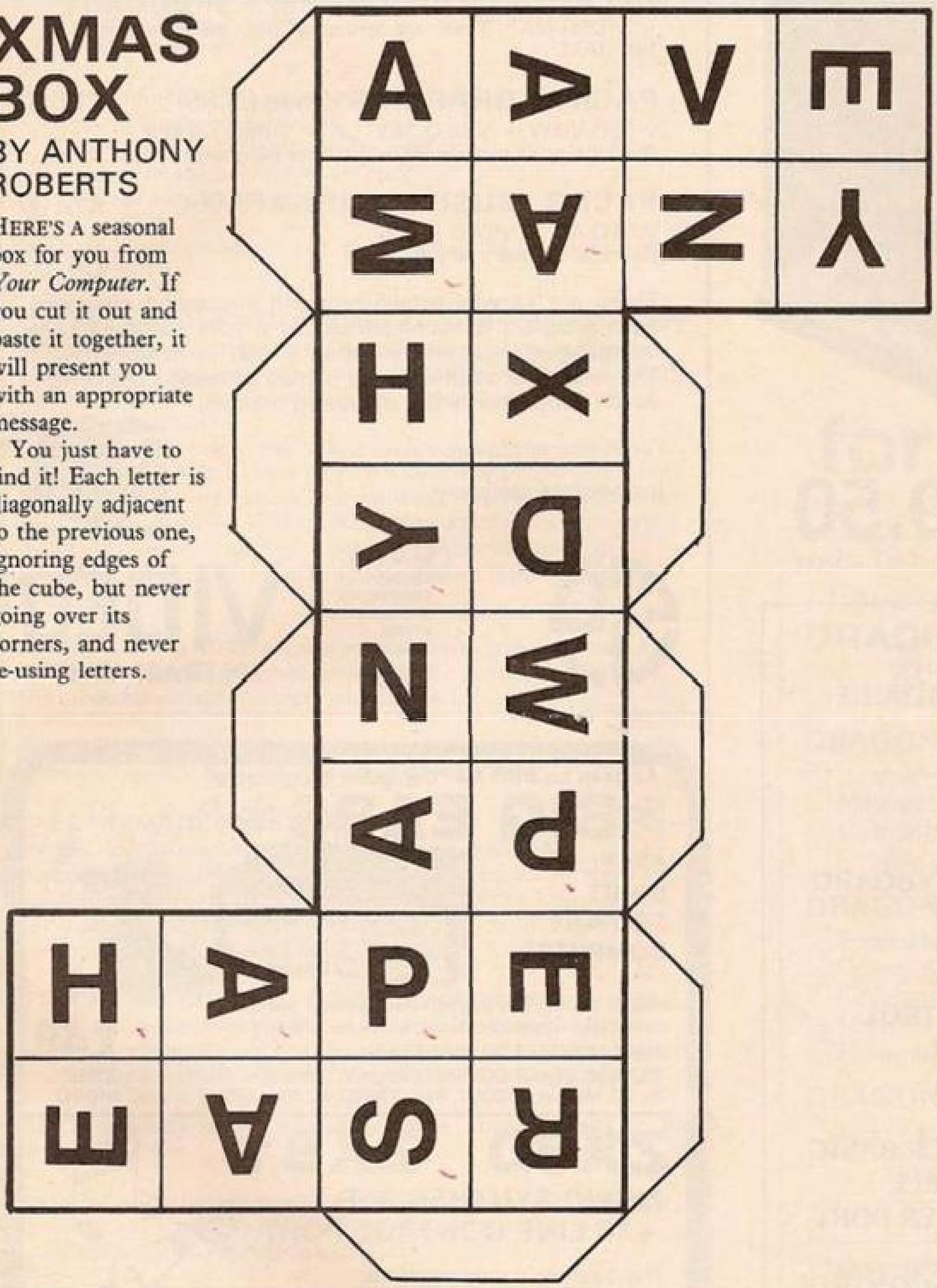
If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

XMAS BOX

BY ANTHONY ROBERTS

HERE'S A seasonal box for you from *Your Computer.* If you cut it out and paste it together, it will present you with an appropriate message.

You just have to find it! Each letter is diagonally adjacent to the previous one, ignoring edges of the cube, but never going over its corners, and never re-using letters.



A B Smith's program to solve the Enigma Code problem.

```
10 REM CODEBREAKER BY A.B.SMITH 10/10/82
20 DIMA$(64),B$(64),C(26),D(26)
30 FORI=1TO64:A$(I)="-":READB$(I):IFB$(I)="000"THENA$(I)=" "
40 NEXT
50 DATA100,102,112,200,010,102,000,201,012,122,221,021,112,202,102,010
60 DATA000,110,010,102,200,210,021,122,000,221,022,021,110,000,001,020
70 DATA001,110,101,000,122,021,212,102,222,100,102,010,000,221,200,010
80 DATA022,020,200,222,102,122,110,000,002,102,022,022,200,010,210,000
100 I=0:FORX=0TO2:FORY=0TO2:FORZ=0TO2:C(I)=X*100+Y*10+Z:I=I+1:NEXT:NEXT:NEXT
110 FORI=1TO64:FORJ=1TO26
120 IFVAL(B$(I))=C(J)THEND(J)=D(J)+1
130 NEXT:NEXT
140 FORI=1TO26:IFI=20THENSTOP
150 PRINTC(I),D(I):NEXT:STOP:GOTO500
200 PRINT"J":FORI=1TO64:PRINTRIGHT$(STR$(I),1);:NEXT:PRINT
210 FORI=1TO64:PRINTA$(I);:NEXT:PRINT:RETURN
500 GOSUB200:PRINT:INPUT"ENTER LOCATION";X:PRINT:INPUT"DESIRED LETTER";D$
510 A$(X)=D$:FORI=1TO64:IFB$(I)=B$(X)THENA$(I)=D$
520 NEXT:GOTO500
READY.
```

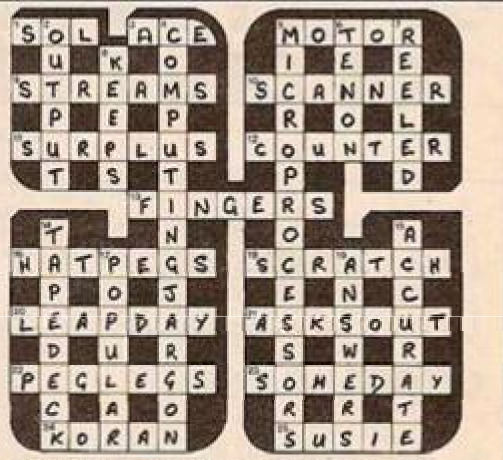
Competition results

OUR PRIZE for the October competition, a Sanyo PHC-25, attracted a disappointing bunch of entries. The imminent Japanese invasion of the home-computer market was clearly not enough to release people's creative juices. Perhaps there was some confusion about the product. P McKenna said that he would use a Sanyo PHC-25 "to shave with".

With due apologies for picking yet another punster, we have awarded the prize to D Blakemore, 141 Bottleacre Lane, Loughborough, Leicestershire, who sounded a sceptical note with "take a Peek to see if it was a flash in Japan".

R Craig hoped to "get a PHD in hi-fi nance" and J Douglas wanted to "fulfil my yen for colour and sound".

We thought it was the Chinese, and not the Japanese, who are supposed to be unable to pronounce the letter "r"; but a number of people like C Hewitt thought otherwise. He



Solution to the October crossword.

suggested using a Sanyo to "reflesh the ports that no other miclo can leach".

Finally, Elizabeth Wright took a more personal line than most with her "bring a little colour into J Conway's life".

Many people found it easy to crack the Enigma Code for our October puzzle. The deciphered message read: "Beware gunpowder treason plot fifth November Parliament cellars". Only a few programs were submitted so we gave the £15 book token to the first entry picked from the bag, from C Davis, 31 Avondale Road, Palmers Green, London N13 4DX.

Here is Anthony Roberts' own explanation of the puzzle: "Each character is represented by three symbols, each of which may be in three states — missing, outline or black — so there are 3^3 possible codes — one for the letters A-Z and one for space. The instructions say that the codes and letters are in strict sequence, so all that remains is to see in which order to take the symbols and the three states. A simple group of nested For statements tried out in turn against the code would soon reveal the message: there are 3! × 3! that is, 36 possibilities, only one of which gives the message".

No-one supplied a program to print all 36 possibilities but the program on the left from previous winner A Smith, could easily be adapted to do so. ■

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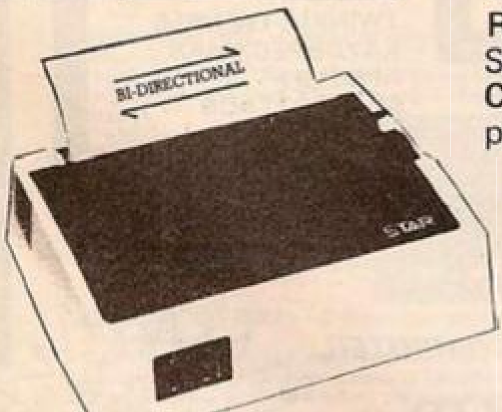
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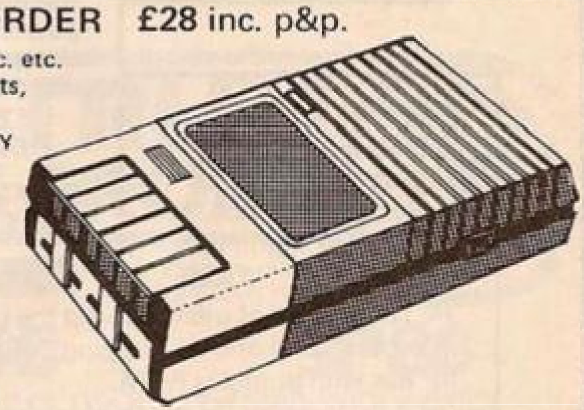
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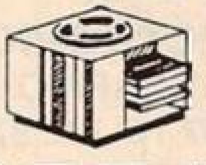
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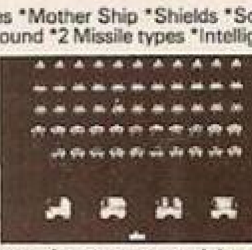
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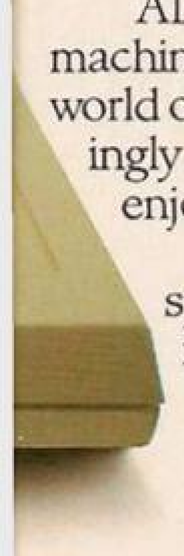
And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

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PRODUCT / FEATURE	DRAGON 32	SINCLAIR SPECTRUM	ACORN ATOM	VIC 20	TI 99/4A	BBC MICRO 'A'
PRICE	£199	£125	£175	£190	£199	£300
STANDARD RAM SIZE	32K	16K	8K	5K	16K	16K
STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS	26K	9K	N/A	N/A	14K	3K
EXTENDED MICROSOFT BASIC AS STANDARD	YES	NO	NO	NO	NO	NO
PROFESSIONAL-TYPE KEYBOARD	YES	NO	YES	YES	YES	YES

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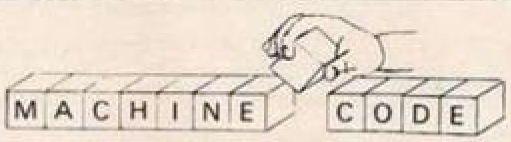
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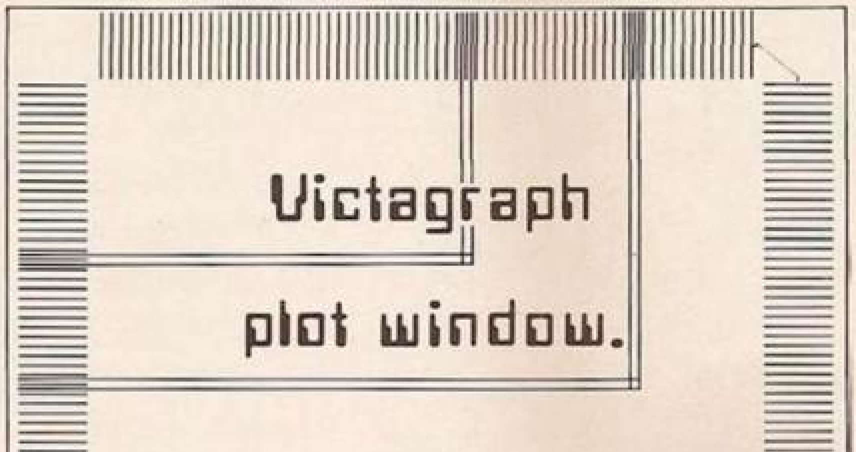
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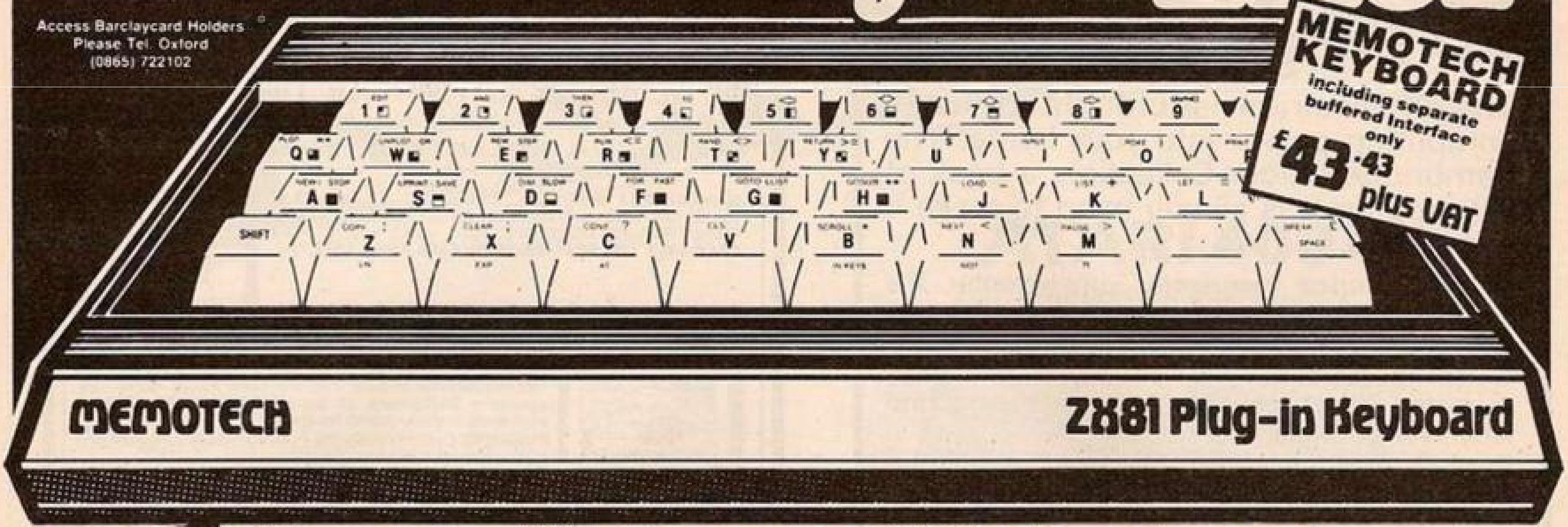
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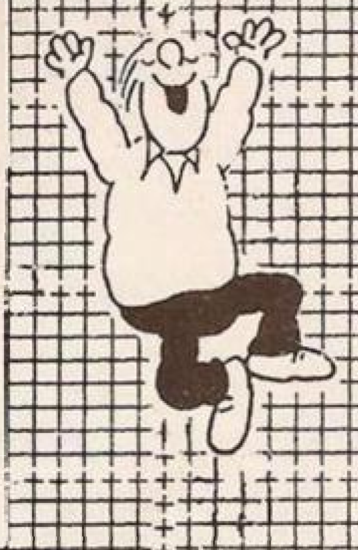
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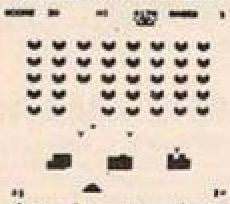
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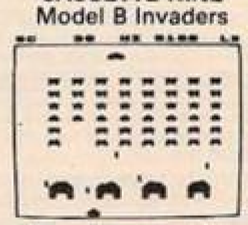


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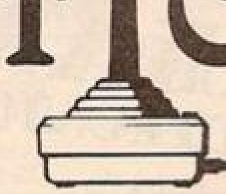
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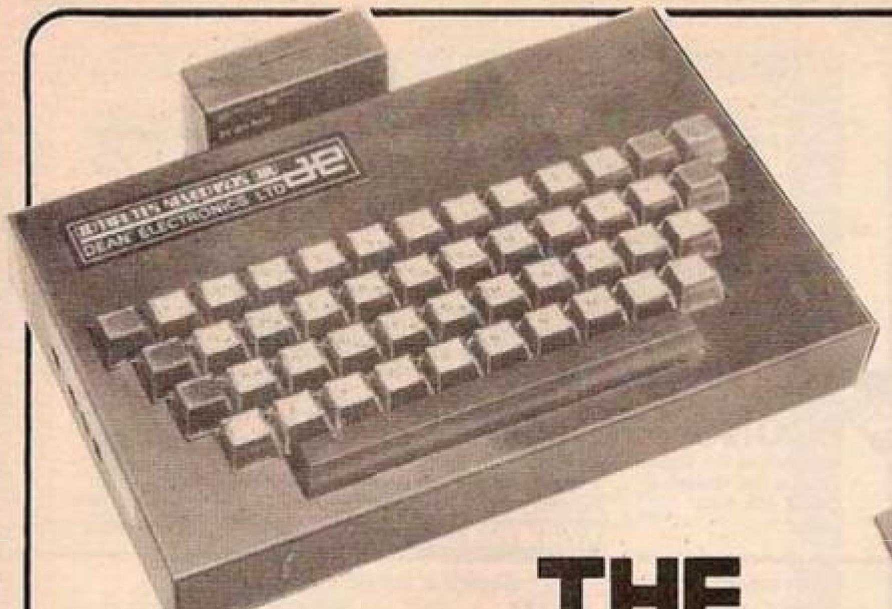
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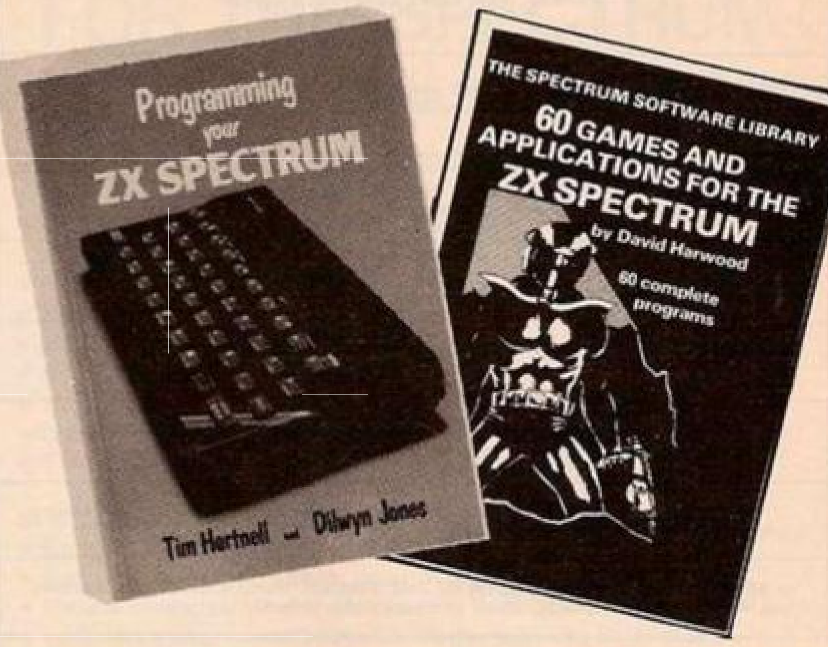
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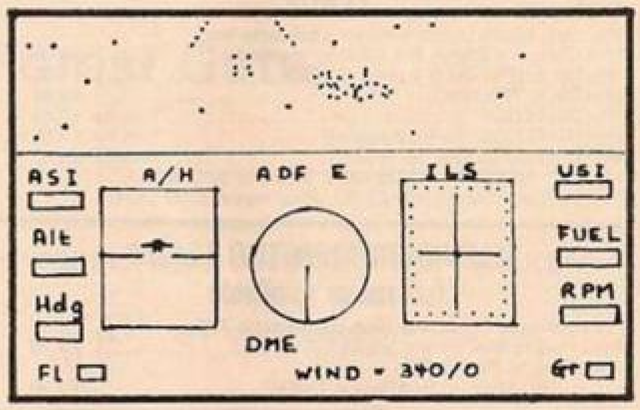
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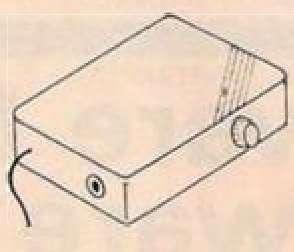
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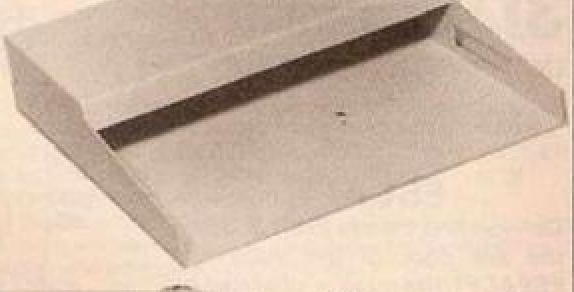
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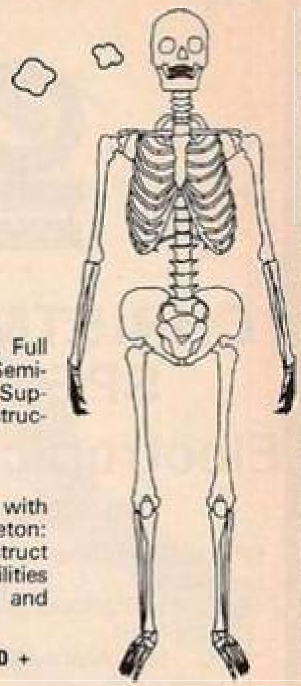
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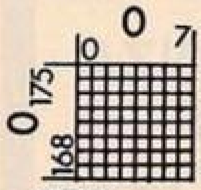
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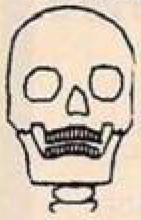
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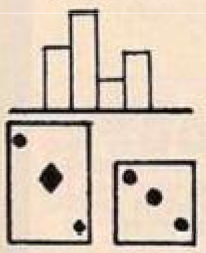


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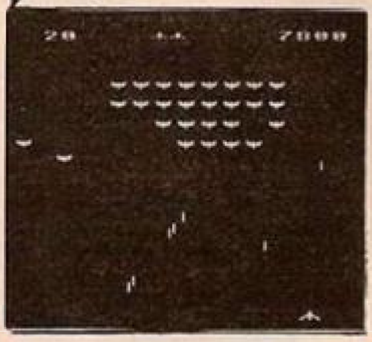
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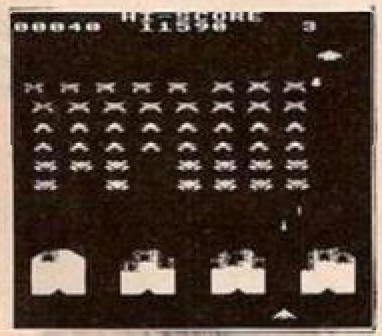
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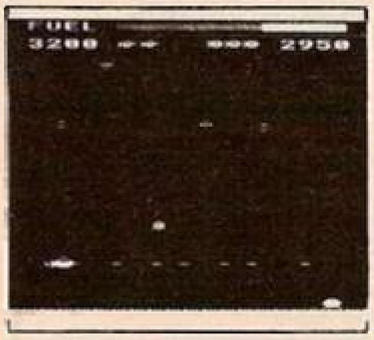
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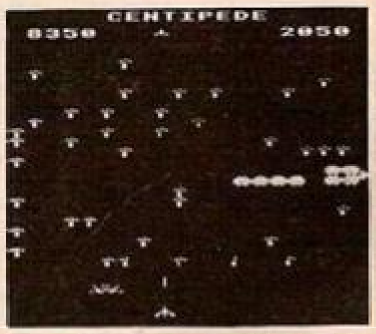
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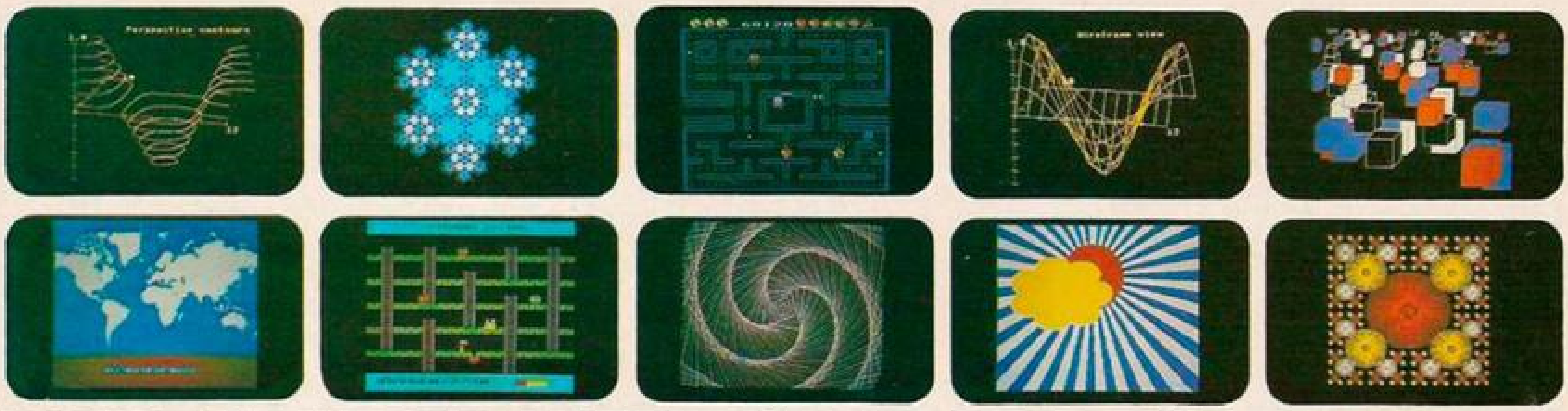
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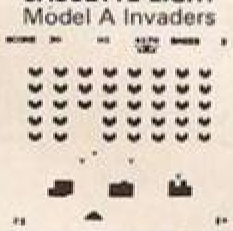
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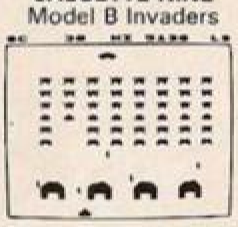


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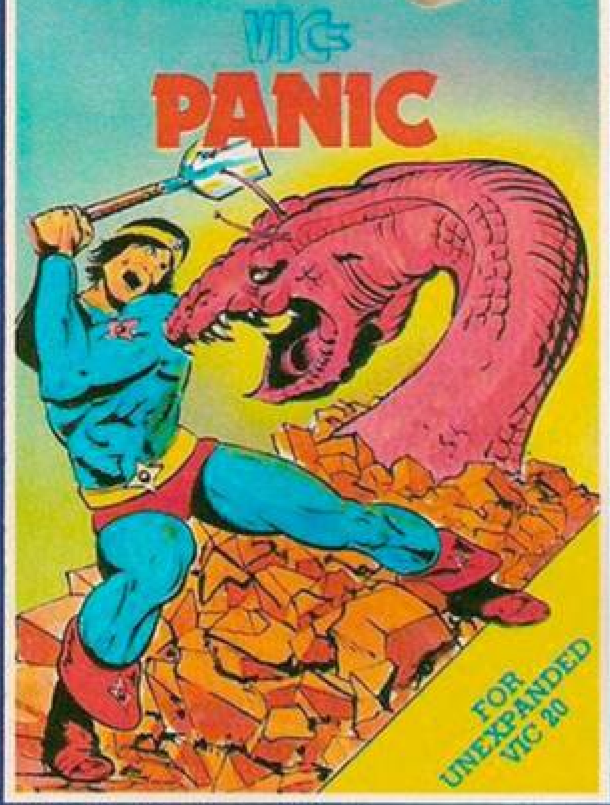


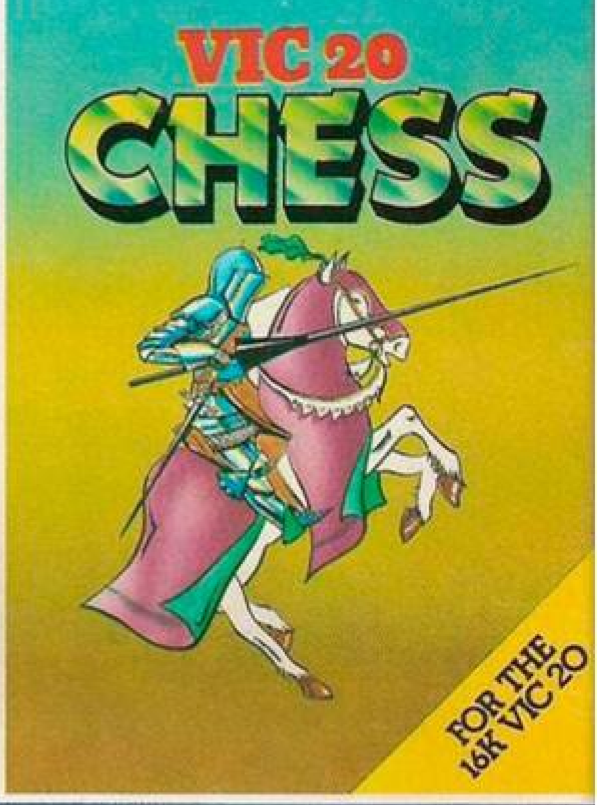
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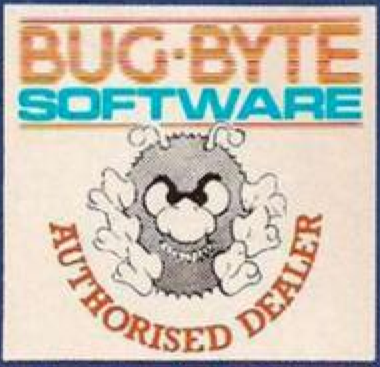
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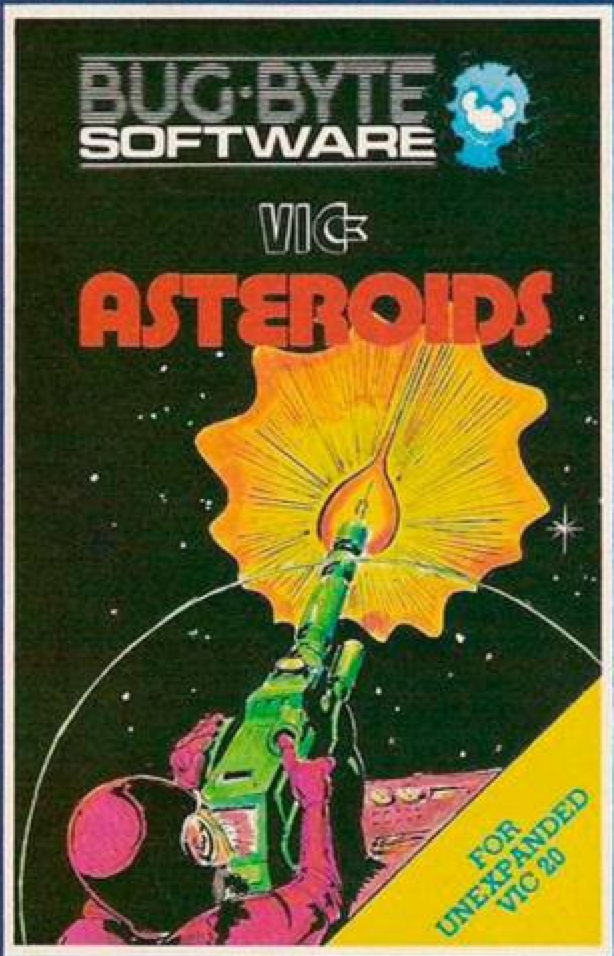
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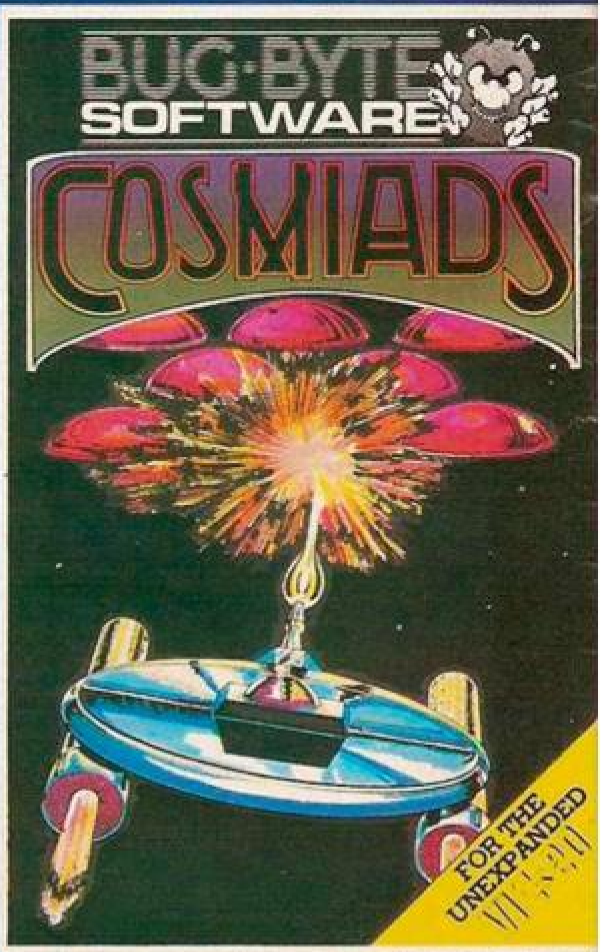






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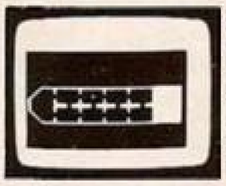
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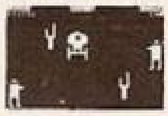
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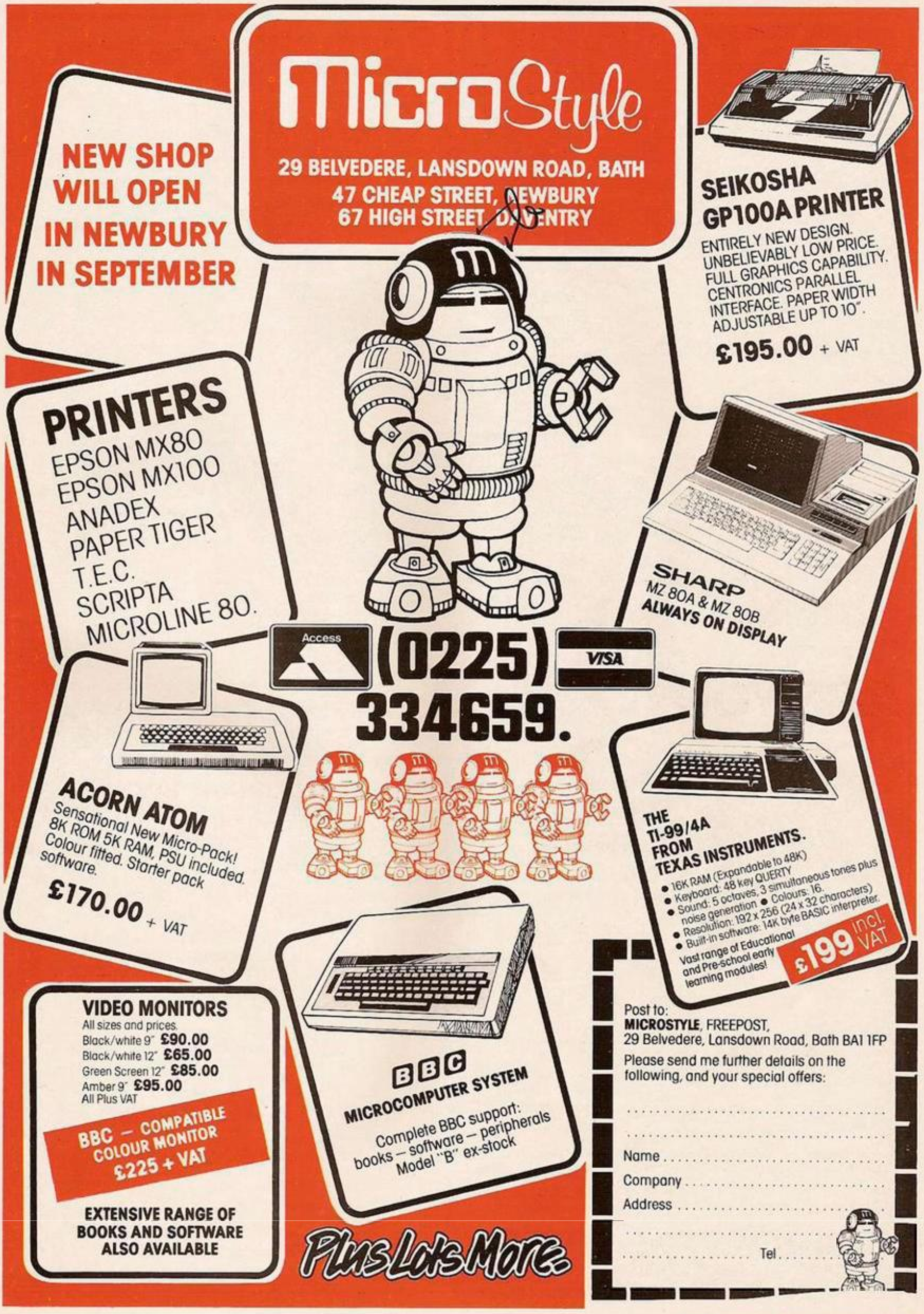
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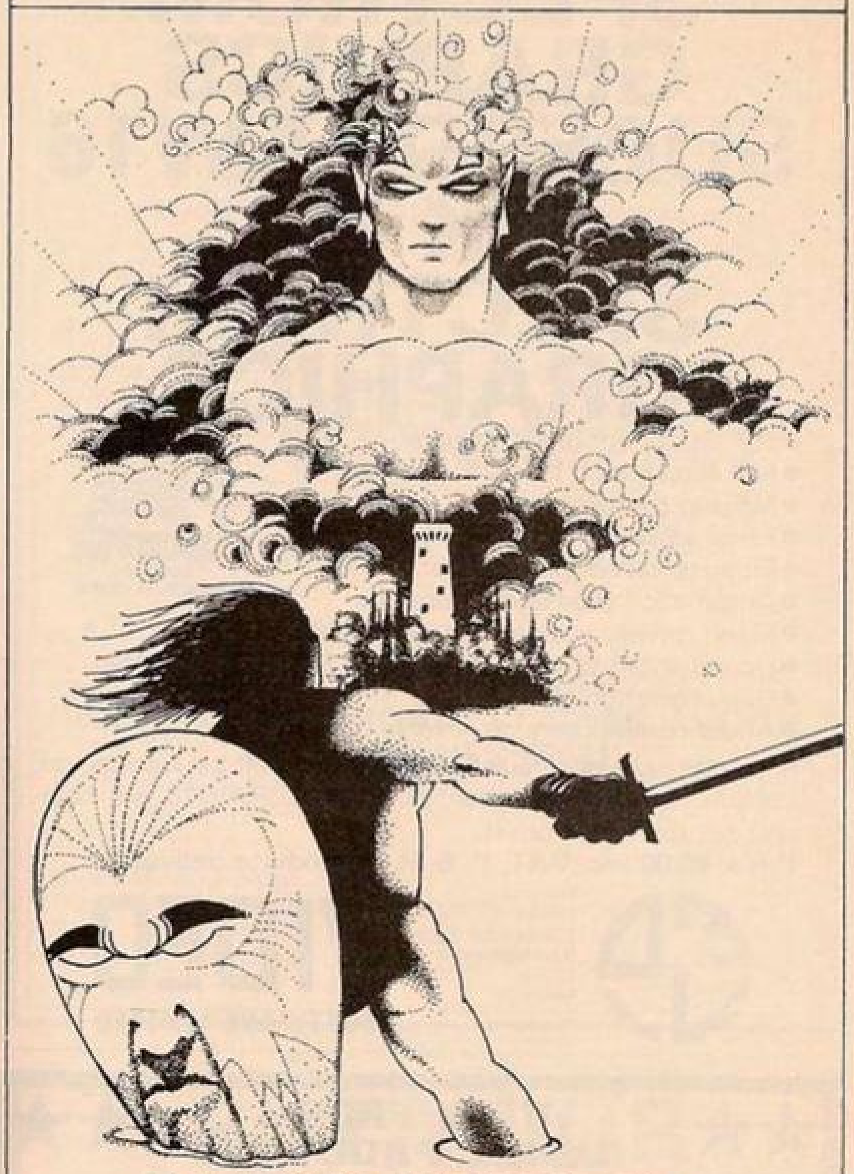
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BREAKOUT . . . this is a colourful bat and ball game with great sound effects and constitutes a very addictive game for the Spectrum.

CRAZY RACE . . . this is an amusing game involving a car being driven around a racing track by you knocking down as many objects as possible whilst avoiding other cars. It is fast and uses detailed graphics.

SUBHUNT . . . as a pilot of a helicopter you have to fire down at submarines whilst avoiding their missiles. The user-defined graphics are superb.

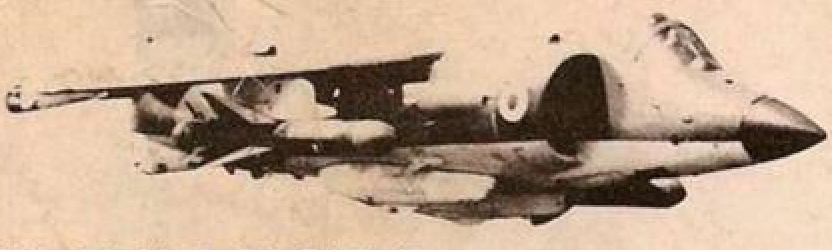
MISSILE COMMANDER . . . this game involves defending your city against alien attack. It has 10 skill levels and is noisy and colourful.

LUNAR LANDING . . . by making full use of your limited fuel and time you have to land your spacecraft on the surface of the moon without crashing and killing all the crew. This program makes full use of hi-res graphics and programmable characters.

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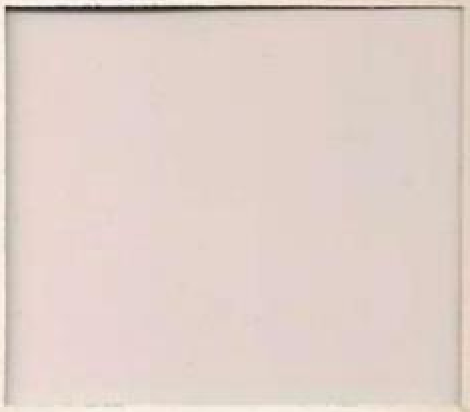
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The HX-20 is a real computer, not a gimmicky toy. Or an extension of your calculator. Or just another desk top computer. It is a precision machine with 16k RAM which is optionally expandable to 32k and 32k ROM expandable to 64k, RS-232C and serial interfaces.

The full size ASCII typewriter keyboard and five programmable keys brings ten separate program functions to your fingertips.



The HX-20 can run on its own power supply for over 50 hours which can be easily recharged overnight, and has the ability to retain its memory in RAM even when switched off.

Virtual Screen keeps you in the picture.

The HX-20's LCD Screen is unique, keeping you in the picture by showing any 20 characters by 4 lines at a time. You can, therefore, carry out word processing or data entry as if you are using a large screen.



Upper and lower case letters, numerals, punctuation marks and graphics are easily read by simply adjusting the viewing angle.

Print out. Built in.

A built-in 24 column dot matrix impact microprinter offers 42 LPM in a crisp, precise 5 x 7 matrix for perfect hard copies on plain paper. Every time.

And there's more. . .Bit addressable graphics allow you to design your own characters for full graphic capability, a cartridge ribbon, full ASCII character set including £ sign and enough international symbols for reproducing most Western languages.



Add-on capability.

Choose from a wide range of peripherals. Barcode readers, audio cassette for loading and saving programs, microcassette and ROM cartridges, and the world famous Epson dot matrix computer printers for quality output . . .to name just a few.



Via acoustic couplers this superb machine can also be linked through the telephone to other computers.



Software and the hard facts.

The HX-20 uses a full extended version of Microsoft BASIC, with a 24 hour clock, date and alarm, string functions, and music generation. The interface options (with RS-232C and serial interfaces as standard) include a standard cassette, a ROM cartridge, plus a system bus that allows you to expand the RAM and ROM capabilities.

The HX-20. The most complete portable computer available today.



Portability for Programability. Anywhere.

The HX-20 is light and totally portable for writing programs and manipulating data – virtually anywhere. (Just four nickel-cadmium batteries and a low power all-CMOS memory gives you a reliable power source during your travels.)

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A computer coming from Epson has got to be good. After all we have been responsible for high quality precision manufacture since 1961. Just take a look at our impressive track record with the hugely successful Epson dot matrix printers.

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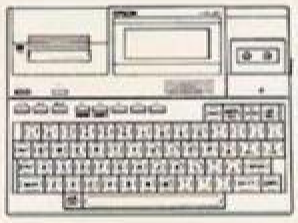
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Specifications of HX-20

Dimensions and Ambient Conditions

Dimensions and Weight



1. Dimensions: 290mm wide, 215.5mm deep, 44mm high
2. Weight: Approx. 1.7 kg





Ambient Conditions

1. Temperature: 5°C to 35°C (operating)
5°C to 35°C (charging)
–5°C to 40°C (data storage) (RAM battery backup)
–20°C to 60°C (non-operating)
2. Relative humidity: 10% to 80% (operating, no condensation)
10% to 80% (non-operating, no condensation)
3. Shock resistance: 1 G for 1 ms maximum (operating)
4. Vibration resistance: 0.25G 55 Hz maximum (operating)

Power Supply (Nicd batteries)

1. Voltage: 4.5V to 6.0V (operating)
4.0V to 6.0V (data storage)
4.5V (low voltage detection)
2. Battery capacity: Approx. 1100 mAH

AC Adaptor

1. Input voltage: AC 220V/240V ± 10%
2. Power consumption: 8W
3. Insulation resistance: 10megohms between AC power supply and case
4. Insulation strength: Can withstand 1 kV applied between AC power supply and case for 1 minute or more

Microprinter (M-160)

1. Printing system: Dot impact (4 printing solenoids)
2. Printing format
a. Total number of dots: 144 dots maximum/dot line
b. Number of characters per line: 24 maximum
(5 x 7 dots; character-to-character space 1 dot)
(6 characters/printing solenoid)
3. Printing speed
a. 1 dot line: Approx. 150 ms (continuous printing)
b. 5 x 7 dot matrix (interline space 3 dots): Approx. 0.7 line/s (continuous printing)
42 lines per minute
4. Character size
a. Dot spacing: 0.33mm horizontal
0.33mm vertical
b. 5 x 7 dot matrix: 1.7mm wide, 2.4mm high
5. Recording paper
a. Kind: Plain paper
b. Paper width: 57.5 ± 0.5mm
c. Outside diameter: 50mm or less
d. Thickness: 0.07mm
e. Weight: 52.3 g/m² (45 kg/1000 sheets/1091 sheets x 788mm)
6. Paper feed: Automatic feed every dot line; with paper release
7. Inking
Ribbon cartridge type
Automatic continuous feed during motor operation
a. Colour: Purple/Black
b. Dimensions: Approx. 91mm wide, 25mm deep, 7mm high
c. Life: Approx. 10,000 lines
d. Standard: ERC-09

Liquid Crystal Display

1. Text: Upper and lower case, numerals, symbols, graphic characters and more; 20 characters per line; 4 lines in total (20 x 4 = 80 characters)
2. Graphic: 120 dots (horizontal) x 32 dots (vertical) = 3840 dots
3. View angle adjustment: Adjustable with VIEW ANGLE density control

Keyboard

1. Key switches: Typewriter layout, full size. 68 keys (including 5 function keys and 13 special keys)
2. Others: Power on switch, VIEW ANGLE density control for LCD, and adjusting circuit built in

RS-232C Interface

1. Connector: DIN (8-pin) TCS 4480
2. Input and output levels: RS-232C standard
3. Transfer speed: 110, 150, 300, 600, 1200, 2400, 4800 bps (selectable by operator)

Serial Interface

1. Connector: DIN (5-pin) TCS 4450
2. Input and output levels: RS-232C standard
3. Transfer speed: 38, 150, 400, 600, 4800 bps (selectable by operator).

HX-20
PORTABLE COMPUTER

EPSON

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Middlesex HA9 6UH
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